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VOL. I JANUARY 1900 No. 4

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The Automobile Magazine

VOL. I JANUARY 1900 No. 4

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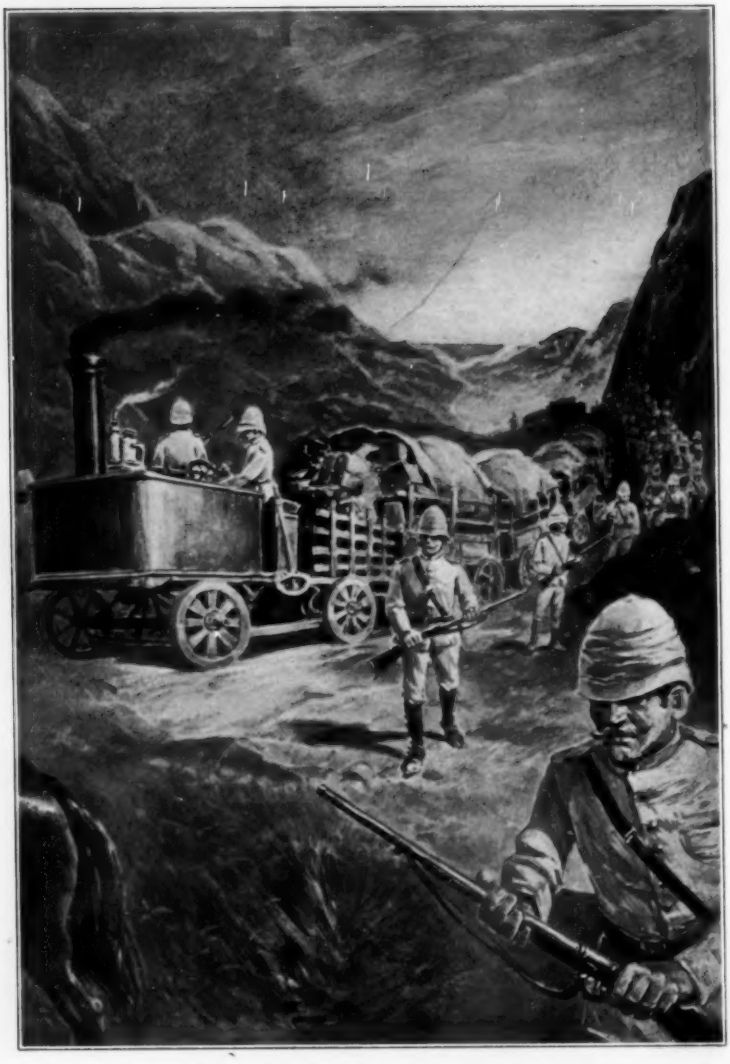

A Traction Train in the Transvaal

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The Automobile
MAGAZINE

VOL. I JANUARY 1900 NO. 4

The Automobile in Traction

By Robert H. Thurston

(Director of Sibley College, Cornell University)

THE term "automobile," in the widest sense of the word, covers every form of self-moving vehicle, every application of stored energy to the useful work of propelling wagons or carriages, whether on the common road or on the rail. It has come to signify, however, only the former of these two classes, although the essential features of construction and the vital principles of successful action are the same in both. In this restricted sense, the vehicle which first became recognized as a practical success was a "steam-carriage," and its success was complete and triumphant, from the point of view of the engineer and constructor, two generations ago. The early steam automobiles of Hancock and Gurney, of Sir Charles Dance, and of Gordon and James, in the "early thirties," were most satisfactory constructions, when the state of the mechanic arts at the time is considered, and were promising a great commercial and financial success when, a few years later, adverse legislation and direct interference, in the interests of the stage-coach proprietors and related enterprises, and the rise of the railway, brought these great pioneers to an abrupt halt.

The conditions of complete success are simplicity and power in the machinery, safety and economy in operation, and good and unobstructed roads. These conditions were fully met in the work of those early constructors. Steam in "water-tube" or "safety" boilers, at pressures of 200 and 300 pounds on the square inch, was employed, with entire success in all respects.

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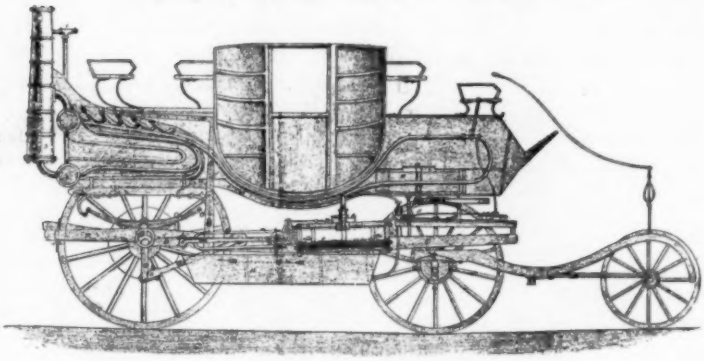
Steam-engines were made so light and so strong that no difficulty arose in their employment in motor-carriages. The combination of the boiler and engine with the carriage was an admirable illustration of ideal engineering for the time.

These carriages were in operation for months at a time, and ran over roads of, often, very considerable inclination, and through the most crowded London streets, conveying crowds of people, and without danger to the passengers or to drivers of horses met on the way. They attained speeds of 20 and 25 miles an hour, and made long journeys to various distant towns and cities. They carried thousands of passengers and traveled with them thousands of miles. In 1833, about twenty of these automobiles were regularly traversing the streets of London and its suburbs.* The hostile legislation which interrupted the wonderful development, at the time, of this promising application of invention and the mechanic arts to transportation on the highway has only recently been repealed to such extent as to permit the beginning of a revival to be made. Even now, some discrimination against automobiles still exists in the legislation of Great Britain. On the Continent, less difficulty has arisen on this score, and there has consequently been, especially in France, a more rapid and extensive introduction of the later inventions in this line than elsewhere.

The experimental work of the first half of the century, however, established these facts, if we may accept the report of a Parliamentary Commission of that time, and the testimony given before it by Farey and other great mechanics and engineers of that period: These automobiles were speedy, safe and commodious; they were light of weight and powerful as to motor; they could traverse any roads on which horses could work; they were a less costly conveyance than vehicles drawn by horses at the same speeds; they improved rather than injured the roads, and they did not, in any serious degree, frighten horses or impede common traffic.

After the automobile employed in passenger conveyance was driven off the common road, the "road-locomotive" remained the only representative of this class of automobiles. It was built as an agricultural engine mainly, and employed in hauling the plough and in towing trains of wagons about farms and from point to point in the country, and gradually came to assume considerable importance. By the year 1875 there were a number of firms on both sides the Atlantic building this class of automobile; among whom that of Aveling & Porter, still well-known in this

*History of the Growth of the Steam-Engine; p. 169.



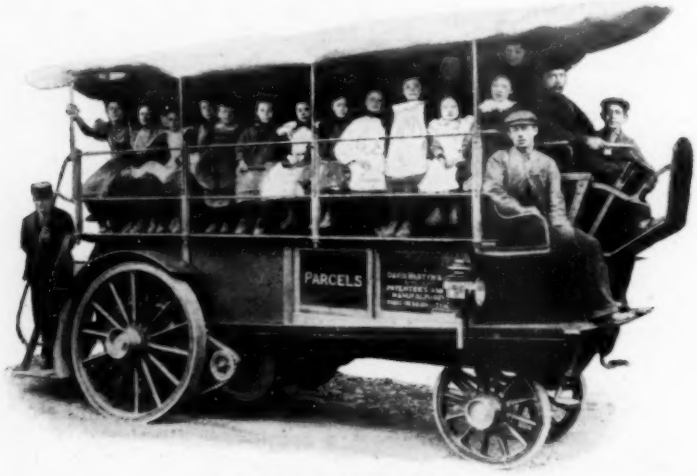
Gurney's Steam Coach

trade, had by that time built up a considerable business in this direction, and supplied such machines not only to buyers in Great Britain, but in all her colonies, and some to the United States. As the pioneers of the heavy automobile for heavy traffic, these engines retain great interest, as well as because of the fact that their manufacture still continues with increasing extent of distribution.

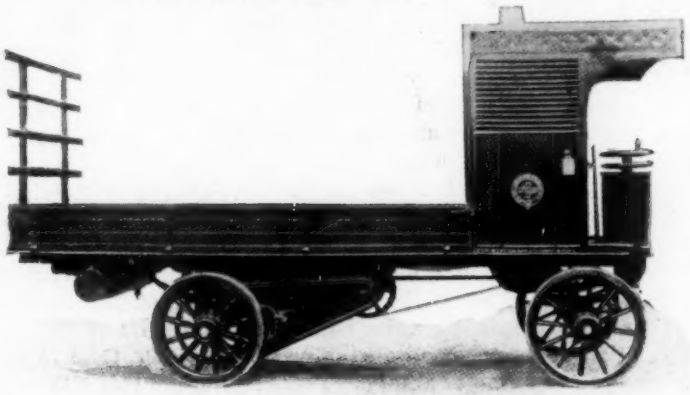
The writer, called upon to make a formal trial of one of these road-locomotives at about that time, found that an automobile "tractor" weighing about five tons was capable of drawing a load of over ten tons, on a good road, up a gradient of 533 feet to the mile at the rate of four miles an hour, and nearly thirty tons up a rise of 225 feet to the mile. The construction was substantially that of a light steam-locomotive, as commonly built for the steam-railway, with such special modifications as were compelled by the roughness of the highway, which it must be able to traverse smoothly and safely. The principal special devices observable were its system of suspension, its arrangements for steering by pivoting the front axle, and a peculiarly ingenious device for permitting the hind wheels, while both serving as drivers, to travel independently of each other in turning corners or following a devious path. This same construction is still to be seen in nearly all the road-locomotives and traction-engines of our own time.

To-day, the automobile for traction is constructed in a great variety of forms and for a variety of special purposes, and steam, air, vapor and electric drives are employed; the latter finding extensive use in the cities, where current is easily obtained for charging its batteries; the first-named motor-fluid is used for the

heavier work, and petroleum vapors serve well in long-distance work of a lighter character. All are in a tentative stage in the sense that no one can say yet which, if either, will ultimately prove the most generally useful; but it would now seem extremely probable that all will continue, for a long time to come, to find employment in one or another of the many branches of automobile work looming up before the mechanical engineer. At present, it can only be said that, for heavy work, such as is the subject of our discussion, and especially for long-distance transportation, steam seems likely to retain that pre-eminence which it has acquired during the two-thirds of a century in which it has been growing up to its task and evolving satisfactory forms and proportions of mechanism. The electric motor and traction-engine is proving itself capable of doing good work wherever current can be found with certainty, of the right kind and in ample quantity whenever demanded, and the later vapor-engines are coming into use for intermediate conditions, where current is not to be obtained as wanted and where rapid motion over long routes is desired. Steam road-locomotives are in use in thousands and have been numerous, wherever extensive operations are carried on, for many years. Petroleum vapor machines are now built in hundreds, and the electro-mobile traction-engine is coming to be a familiar machine in cities, at steam-railway tunnels and in mining. The compressed-air automobile finds a place



An Automobile Omnibus



The Layland Lorry

where air is stored for use in accessible locations and ample volume.

A parade of fifteen steam road-locomotives, towing forty trucks, as a supply train to be shipped to South Africa, recently, at Aldershot, England, gives some suggestion of the extent to which that form of automobile has come to be employed in ordinary heavy highway transportation. A line of automobiles is reported to have just been planned for Porto Rico, between Ponce and San Juan, carrying both freight and passengers. A system of automobile traction on the Erie and other canals is another of the signs of progress; while the shipment of scores of motor-trucks to England and to France by our own manufacturers indicates that the United States will soon lead in this department of mechanical engineering, as it already does in that of electric railways and their machinery, contracts for which are now coming to our builders in million-dollar bargains.

The economy of the automobile system comes out in high relief when the working of the heavy classes of machines for business purposes is studied. The costs of maintenance and of repairs and the estimates for depreciation are large as percentages of the original costs of purchase; but in comparison with horse-power, the only comparison of interest in this connection, it is found that the fuel-account of the machine and that of the animal differ so enormously in favor of the former as to decide any question of profit quite apart from the consideration of the rapid deterioration of the horse in heavy work. The fact that street-car horses have but two to four years of profitable employment and

meantime depreciate fifty per cent. and more in value obviously gives sufficient evidence that the machine may not be relatively, even if absolutely, short-lived; while the continued working of locomotives on the railway for a generation, with slight diminution of efficiency, may be taken as proof that good care in management and maintenance may insure long life and a comparatively small percentage of total depreciation for the automobile.

The Judges of the Liverpool Trial of the heavy automobiles exhibited by the "Self-propelled Traffic Association" of last year report some instructive deductions from their experiences. Maintenance is estimated by them at 20 per cent. and 30 per cent., according to character of automobile and its work, and depreciation at 15 per cent. on the prime cost, or a total of not less than 35 per cent. per annum. This assumption that one must be prepared to replace the capital invested, practically, every three years, seems somewhat intimidating; yet it is found to be the fact that, even so, the gain by the introduction of the heavy automobile for the performance of work formerly entirely carried on with draught-horses is a very considerable net return on the investment; it being understood that the automobile is given ten hours' work a day—it may be worked twenty-four hours a day—and on good paved roads. With a rougher road the profit would become still greater, comparatively, though absolute costs would rapidly increase with the roughness of the track; it being further understood that the traffic is carried on over ordinary and fairly maintained highways, well within the limits of the machine. The life and efficiency of the automobile increases rapidly, however, with improvement of the roadbed. It will be interesting to compare this report with that of the Parliamentary committee of the time of Hancock and Gurney and Gordon. Its substance is as follows:*

The automobiles experimented with were all capable of substitution for horse-drawn vehicles with economy; loads up to four tons weight were transported successfully over roads thirty to forty miles in length in the neighborhood of Liverpool; the costs of transportation in the cases examined were less than the charges for railway transportation in the same district, though the committee is not certain that this apparent gain can be taken as probably general, since the severity of the work of the road-vehicle may make costs of maintenance excessive after a time.

It was found that motor-vehicles were then somewhat liable to breakdowns; but it was believed that, after some little experience, the evolution of correct proportions of parts and the use of

*Ibidem; p. 171.

materials precisely adapted to their peculiar requirements may be expected to reduce this risk. This risk of accident was, however, less a fault of construction of the machine than of the road, in the usual case, and the construction of good roads was, in this case, as in that of the bicycle, the prime prerequisite of successful utilization, with maximum economy and profit, of the automobile of whatever form or class. Wet, muddy and heavy roads increased costs of operation, as well as of repair and maintenance and the risks of use, of these vehicles enormously, and improvement of the roadbed similarly increases the economy and the safety of operation of the machine in very large proportion. Under the ideal conditions of city work on smooth and well-cared-for pavement, the automobile becomes at once safe and very profitable. It was found to be the fact, however, that the automobile could traverse and manœuvre on roads of any sort that horses could work on with profit or were ordinarily required to haul loads over. Control, stopping, starting, steering and reversing were as readily accomplished as with horse-drawn wagons—often more so. Hills were climbed much more readily than with horses; especially where, as should always be the case, variable motor speeds were provided for fast and light and for slow and heavy traffic. Improvements may be expected in these various directions, and especially in the reduction of the care and attention required, in operating the automobile on the part of the person in charge.

With so splendid a beginning the future of this industry can hardly be now imagined.

From the earliest days of the automobile and of invention in this department of mechanical engineering, the obstructions have been largely legislative, and the laws of Great Britain to-day, as sixty-five years ago, by restrictions on weights and speeds, greatly impede progress in this direction. The attempt to forbid the use of the automobile in Central Park is a more modern illustration of the fact that apprehension and ignorant protest may do much to retard advancement of the most promising of arts and inventions.

The proportions of the later designs of heavy steam-automobiles are given in the following table, which represents the judges' figures for the trials of the last summer. It is seen that the weight usually ranged in the neighborhood of three tons, although one approximates two tons. A "trailer" weighed two-thirds of one ton. The Thorneycroft vehicles were built by a firm in which the great torpedo-boat builder was the moving spirit:

Particulars of Steam Motor-Vehicles.

Official No. of Vehicle.	Extreme Dimensions Over All.			Dimensions of Platform.		Available Platform Area.	Diameter of Wheels.	Width of Tires.	Height of Floor Line of Platform.		Length of Wheel Base.	Driving Wheel Gauge.	Angle of Lock.	Capacity of Boiler to Mean Glass	Capacity of Water Tank.	Capacity of Bunkers.	Capacity of Oil Tank.	Tare without Fuel or Water.
	Length.	Breadth.	Height.	Length.	Breadth.				Light.	Laden.								
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	sq. ft.	ft. in.	in.	ft. in.		ft. in	ft. in.	°	gals.	gals.	cwts.	gals.	t. c. q. lb.
1. Thorneycroft..	16 0	6 6	8 5	10 0	6 6	65	F. 2 9 R. 3 3	4⅜ 5¼	3 9½	..	8 11½	5 6½	34	19.25	114	3	..	2 19 3 19
2. Thorneycroft..	18 1	6 6	9 0	12 c½	5 7½	67.7	F. 2 10 R. 3 3	4¼ 5¼	3 9	..	9 11	5 6½	35	25.0	160	5¾	..	3 3 1 9
3. Coulthard	15 7	6 7	9 4	10 5	5 5	56.4	F. 2 9½ R. 2 11½	4 5	3 8⅛	..	9 6	5 8	30	15.0	*56	..	22	2 4 3 1
4. Trailer	10 7	6 2	3 9	10 5½	5 6	57.5	F. 2 8 R. 2 11	3 3	3 7	..	5 6	5 3	..	..	..	..	..	0 14 2 27
5. Leyland.....	18 2	6 5	10 1	12 6	5 8	70.8	F. 3 3 R. 3 3	4 5	3 9½	..	9 11	5 3	26	22	50	..	20	2 17 0 1
6. Clarkson	17 9	6 5	10 10	11 0	6 4	69.7	F. 3 2 R. 3 5	4½ 4½	4 0	..	9 11	5 3	31	..	..	..	27	2 19 3 20
9. Bayleys	16 5	6 6	8 7	9 9½	6 2½	60.8	F. 2 8½ R. 2 11	4⅛ 5¼	3 9½	..	8 5½	5 8	25	19	82	3	..	2 19 1 7

* Hot well in addition.

This list seems a remarkably short one, when it is considered that it is reported that there are no less than 110 builders of automobiles in Great Britain; but they commonly confine themselves to the construction of the lighter classes of carriages.*

A sample English construction of this class is seen in the accompanying illustration, the first on the list, built on the Thorneycroft system. Like the majority of these heavy automobiles, it is a steam-motor. A steel frame carries a platform of 65 square feet area, for merchandise, supported by springs, as in railway constructions, and on the forward part of the frame is mounted the motor-machinery. The boiler has 75 square feet area of heating surface, encloses 19 gallons of water, and has a steam-pressure of 175 pounds, which can be safely

A Typical Traction Autocar

raised, if desired, to 200. About 114 gallons of feed-water and 350 pounds of fuel (coke) are taken on at starting. The latter is carried in bunkers enclosing and guarding the machinery at the forward end of the frame. Compound engines, $4 + 7 \times 5$ inches, in general dimensions, with a maximum speed of 450 revolutions per minute, are geared down to two speeds, through an intermediate shaft and differential gear, to the axle. The power is transmitted over springs directly to the tires, and not through the spokes, as is often done by other builders.

A machine built for work in South Africa is that of Messrs. Coulthard. It is comparatively light, carries a working pres-

*It is reported that there are about 600 builders in France, 110 in England, 80 in Germany and 60 in the United States. The automobile "shows" in London and in Paris have drawn together about 200 exhibitors each. Thirty of the larger companies in the United States have a capitalization averaging over $5,000,000 each.

sure on its boiler of 200 to 225, testing to 450 pounds, per square inch. It carries an air-condenser, which produces considerable economy. Oil-fuel is employed. The engine is triple-expansion, developing 15 horse-power at 500 revolutions per minute, its cylinders measuring $2\frac{3}{4} + 4\frac{1}{8} + 6 \times 5$ inches. The transmission consists of spur gearing and friction clutches. The other vehicles differ in details, but all properly fall into one class. That they have been given practicable and practical forms and are admirable constructions may be inferred from the fact that their trials were upon a macadam and cobble-stone pavement and on inclines of from 1 in 14 to 1 in 9; the mean being 1 in 12.3. The long-distance trials were over neighboring country roads, and a distance was covered of over 35 miles. On both trials, and

Columbia Electric Omnibus

whether loaded or unloaded, it was found perfectly practicable to stop, start and manœuvre readily, both on the level road and on the steep inclines; the latter being, in fact, too steep for use of horses and loaded vehicles.

In the latest trials of vehicles of this class, heavy automobiles, weighing from 5 to 8 tons, were sent over long-distance routes, with loads of from 2 to 4 tons, at speeds of 4 to 6 miles an hour, with consumptions of fuel ranging from 125 to 200 pounds of coal or coke, and of 3 to 4 gallons of petroleum, or from 6 to 10 pounds and from one-eighth to one-fifth gallon, per mile; making the 20 miles in four to five hours, usually. One heavy auto-

Thorneycroft's Steam Wagon

mobile, on a speed-trial, made an average of nearly 27 miles an hour for one mile. These figures seem to the ordinary reader remarkable, and yet they are not so far different from those of the great automobilists of seventy years ago. The fact that "history repeats itself" is in this case true in a perfectly literal sense.

Another year remains before the close of the XIXth century, the century having progress in mechanical engineering as its salient characteristic, the century of the birth and marvelously rapid maturing of every system of modern industry. The life of the automobile began with the century, and a short hundred years —in fact, two widely separated decades of the century, the years 1825–35 and 1890–1900—have produced practically all that we now recognize as valuable in the introduction of self-propelled vehicles on the highway; although it is, of course, obvious that advances in detail in all other directions, in the application of the motors of various classes to a variety of purposes have had much to do with the final success of this class of inventions. The conclusions of the Parliamentary Committee of sixty-five years ago have been fully confirmed, and the contemporary automobile is known to be safer, speedier, cheaper, more sanitary, in all ways better, from the commercial and business standpoint, than horse-drawn vehicles. Many millions of dollars are being invested in the manufacture and in the purchase and use of these remarkable vehicles, and they are now evidently come to stay, as practical and economically satisfactory machines. The stage of experimentation is now largely in the past.

In use, the automobile is finding its way into rivalry with the horse on every field of competition, and in none more successfully than in the transportation of merchandise and the haulage of heavy loads. The work begun at the beginning of the century by Trevithick and developed so finely by Hancock and his competitors has never entirely ceased to progress in this department. It had become a large and steadily growing permanent business long before the revival of the automobile for passenger conveyance in either its heavier or its lighter forms.

Automobiles of every sort and fine roads will work together for a common good. The introduction of the self-propelled vehicle will insure the constant pressure of commercial interests in favor of the improvement and extension of systems of well-built roads throughout the country, and the progress of the existing movement in favor of good roads will be effective in the promotion of the introduction of the automobile of every class. The effect of the general use of the bicycle has been enormous in this direction; yet that is in large degree a toy, the minister of pleasure simply, while the automobile may be expected to become a necessity in every department of business and to exert vastly more persistent and more important influence upon legislation and public improvement. Urban traffic must, ere long, become mainly dependent upon the new system of transportation, and suburban greatly modified and improved.

An Automobile Dump Wagon

A Fast American Run

By Hiram Percy Maxim

IN returning from Atlantic City, New Jersey, to Philadelphia, on November 18 last, Mr. Justus B. Entz and the writer, on a Columbia electric automobile, made what is probably the fastest long-distance run yet accomplished by an electric vehicle. What was possible with the carriage was by no means accomplished for reasons that will appear hereinafter. The trip back to Philadelphia concluded a four days' outing, during which several rather elaborate technical determinations were made. No special arrangements had been made for making an official run of it, as had been done on some of the previous runs, so that for other than the start the writer's notes must be taken.

The start was made from the Windsor Hotel in Atlantic City at precisely 11 o'clock A. M. The clerk of the hotel, Mr. Poffenberger, kindly acted as starter and wrote in my note-book the time, cyclometer reading and his signature. The course from the hotel was through Illinois avenue, to Pacific avenue, to Missouri avenue, to Baltic avenue, to the Meadow Turnpike, the sole wagon road out of Atlantic City. At 11.06.10 we stopped one minute at the toll-gate to pay our fare of 15 cents

Awaiting Signal to Start

and to wait for the drawbridge to close and the resulting congested traffic to straighten out. Slow running was, of course, imperative. Out of the traffic, no easy matter to accomplish at high tide, as the water at this time actually stood over the entire highway in many places, we were able to move at a little better pace, although the fearful holes and rough bridges and four badly frightened horses caused many slow-downs, not to speak of four full stops. At the turning of the 5.71 mile mark by our cyclometer, we passed the outer toll-gate, began the ascent of about 500 feet of 4% grade, and gained the main land and wider roads. The time here was 11.25.35, making the rate of speed 13.4 miles per hour. Two minutes later we passed Pleasantville Post-office.

On the wide and hard road good time was possible, although there were many bad spots having deep holes and rough places, resulting several times in nearly throwing us out of the carriage.

At Absecom the Pennsylvania Railroad crosses the highway, and when we arrived we found a gravel train drawn up across the road and engaged in ballasting the roadbed. Absolutely nothing could be done but to stop and wait until they were finished, even lurid language being en-

An Unwelcome Stop

tirely lost on the Italian laborers who were engaged in the work. A photograph was taken to show the trying situation. A dead loss of twelve minutes occurred here, we being permitted to cross at 11.48.45, having stopped at 11.36.40. One minute later we passed the Absecom Post-office, and stopped to secure the signature of the most important looking of the bystanders standing outside of the Post-office, together with the time at which he wrote his signature in my note-book. We then started again, and experienced no interruptions, so that the times and distances recorded became more representative of what the carriage could do.

The first reading after leaving Absecom was the 11.42 mile mark, which was turned at 11.58.55. The average speed from the start, including all the losses of time, was, therefore, at the rate of 11.6 miles per hour. As the slow running necessary across the meadow road caused an unknown delay, the actual running time, deducting the thirteen minutes accounted for, is not computed.

From this on the miles passed are as follows:

*Miles.	Time.
11.42	11.58.55
12.57	12.02.45
13.70	12.06.40
14.86	12.10.20
16.00	12.13.35
17.15	12.16.53
19.42	12.24.22
20.55	12.27.45
21.71	12.31.32
22.85	12.35
24.00	12.38.48
25.14	12.42.12
26.28	12.45.20
27.42	12.48.43
28.57	12.52
29.71	12.55.40
30.85	12.59.10
32.00	1.03
33.14	1.07.10

The fastest mile was seen to be at the rate of 21.8 miles per hour. From the 11.42 mark to the last one recorded above the

* The uneven mileage readings are caused by our cyclometer being a 28" and our wheel a 32", making a multiplication of $\frac{8}{7}$ necessary to get the actual mileages as above given.

H. P. M.

Where the Fastest Time Was Made

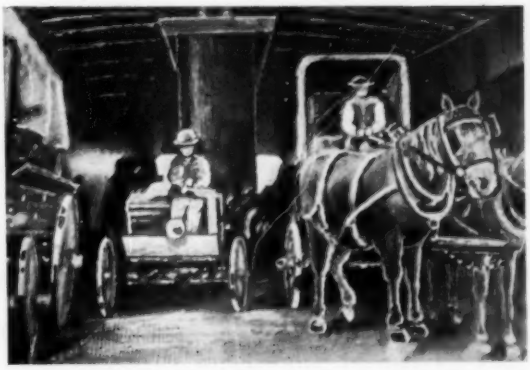
total distance was 21.72 miles, which had been done in the time of 1 hour 8 minutes, or at an average rate for the entire 21.72 miles of 19.2 miles per hour. The last two miles of this was through the Town of Hammonton, where several right angle turns had to be made in the center of the town, where, of course, speed was necessarily slower than could have been run, and furthermore, between the 12.24.22 reading and the 12.31.32 reading a continuous stretch of repaired road was encountered, consisting of loose stones merely thrown in the worn portions of the road.

Single mile readings were discontinued at the last one mentioned above, in order to partake of a lunch which was eaten *en route*, speaking more or less favorably for the steering qualities of the vehicle, as the driver was easily able to eat while running at speeds between fifteen and twenty-five miles an hour, where traffic was light.

At 1.31, after the lunch had been completed and preparations were being made for a continuance of the mile readings, the worst delay of the entire trip occurred. It was brought about by the endeavor to pass a horse-drawn vehicle which was going in the same direction, but

Waiting for a Ferry

much slower than we. The bell was rung continuously, and the occupant of the buggy, after what appeared to be the most thorough deliberation, drew out to one side of the road to let us pass. Having a clear way, we turned on the power to get past, when, without any warning, the driver of the vehicle pulled suddenly directly back into the road. A ditch of considerable depth occupied the other side of the road. Between it and the horse-drawn carriage we struck the latter with most appalling results. Almost a complete capsize of the buggy resulted, we striking it almost head on and receiving no injury ourselves whatever. The occupant of the buggy, however, was, it is needless to say, startled past all comparison by suddenly finding an automobile sitting on the seat beside him. Both right buggy wheels were entirely collapsed, the reach bent and the carriage generally dishevelled. The horse, strange to relate, took the incident as an entire matter of course, and had it not been for our having to unharness him, would doubtless have fallen asleep. The buggy was found to be occupied by a country Doctor wending his way home. It



Crossing the Ferry

Slow speed

was necessary to find a place where his buggy could be left, and to find some one who could be hired to lead his horse home, which was distant six miles. In time this was arranged, and the Doctor persuaded to allow us to take him home on our automobile. After rather involved explanations and exchanging of cards, the three of us packed ourselves away on the little carriage and started for Berlin, the home of the Doctor. The start was effected at 1.58, making a total loss of 27 minutes, which speaks for our diplomatic powers. The Doctor's home in Berlin was reached at 2.20, and we were composed enough to again read the cyclometer, which indicated 46.3 miles. A further delay of two minutes was occasioned in Berlin leaving the physician at his house.

Thereafter it became ill-advised to run at the full speed of the machine, as no more accidents were desired, and as we approached Philadelphia the traffic, of course, became thicker. At exactly 2.40 we passed the 50-mile mark from the start at Atlantic City, and it is interesting to note that the cyclometer, which had been used on the previous day for an official 100-mile run, at this 50-mile mark accurately matched as we passed it this time. The cyclometer was a Veeder and arranged on the right forward wheel. We passed the mark at a speed of about 12 miles per hour, and by pre-arrangements, Mr. Entz decided to shout as the front hubs passed the line, and the writer to shout as the cyclometer turned the 50-mile point. The two shouts were simultaneous.

The Gloucester Pike was passed at 2.55, the cyclometer reading 54.7. At this point we took the road to Gloucester, which for two miles was deep in sand, making even fair speed entirely out of the question. It was decided to take the Gloucester Ferry to Philadelphia. As we approached the ferry the roads naturally became very bad, many of them being the most wretched cobblestones. The Gloucester Ferry was reached at 3.26.35, the cyclometer reading 60.7. The total time, therefore, was 4 hours, 26 minutes, 35 seconds, and the speed, including all stops, 13.6 miles per hour. Deducting every stop, the total time was 3 hours 41 minutes and 35 seconds, which gave an average rate of 16.4 miles per hour. Considering the slow running necessary on the bad roads and in the congested traffic of the first and the last five miles, we may say roughly that the intermediate fifty miles of the run were covered at an average speed of between nineteen and twenty miles per hour.

As it stands, it establishes both the world's record for speed on a long distance run for an electric automobile, and also the Atlantic City-Philadelphia record for any automobile.

Motor Cycle Racing

By Al Reeves

THE racing of motorcycles may still be described as one of the sports of the future. The great success of these races in America last season is proof positive that the new sport will have a large following among those people who delight in athletic competition and speed trials, especially when great danger is apparent.

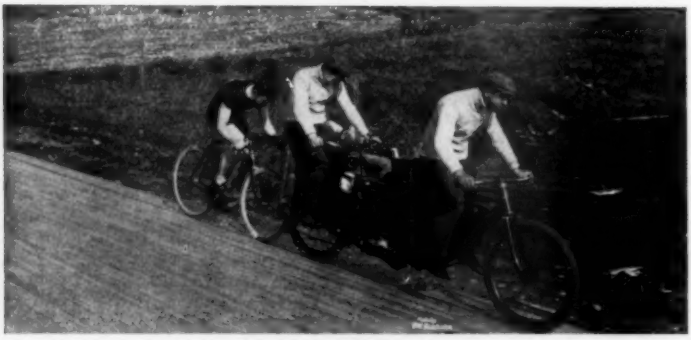
The terrific speed at which these machines whirl around the banked bicycle tracks; the quick, nervous puffing of the motors and the skill and nerve exhibited by the riders who steer and operate them, all seems very fascinating and inspiring to the spectator. Capable of railroad speed when pitted against one another, motorcycles are sure to find favor with the excitement-loving public of this country, particularly those who are interested in motor vehicles. The machines, whether tandems or otherwise, are all of the automobile order and naturally interest the people who proclaim any style of self-propelled machine wheels the vehicle of the future.

Popular as the sport has been from its introduction in this country by Henri Fournier, of Paris, the thrilling pastime of racing on these diminutive locomotives grows even more interesting as faster times are accomplished. Up to the close of 1899 the fastest mile covered by a motorcycle in America has been one

Zimmerman following Fournier's "Infernal Machine" at Asbury Park

minute and nineteen seconds. The feat was accomplished at the Garfield bicycle track in Chicago by the steam tandem which is the property of Major Taylor, who followed it on a bicycle at the same rate of speed. In view of the present early stage of construction, it is evident that, on a properly constructed track, with weather conditions favorable, a mile a minute is the inevitable record of the future.

So far motorcycles propelled by electricity have been shown to be scarcely practical. When such machines do work the speed



Steam Tandem Pacing McDuffee at 1.19 per mile

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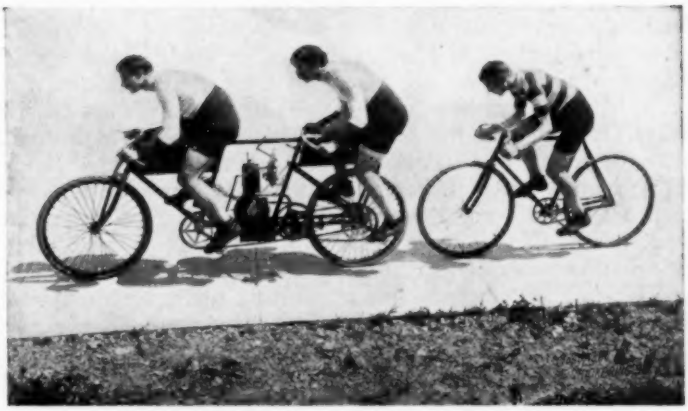
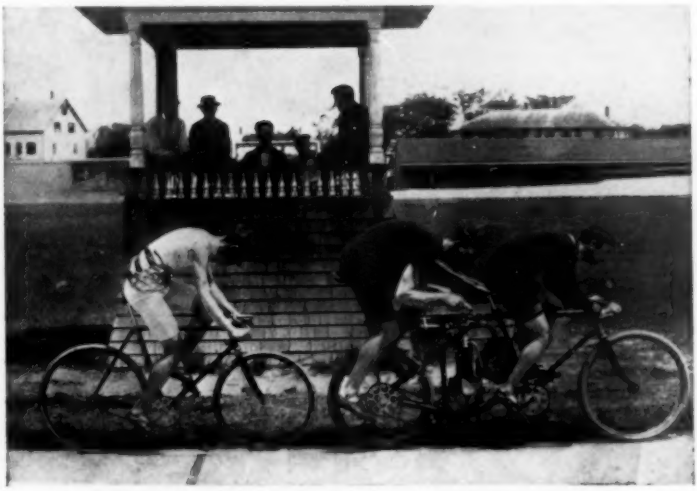


Caboillet and Marks Pacing Linton

Copyrighted by E. Chickering

is wonderful, but the uncertainty of the power tends to preclude their use for competition. In fact, some of the European tracks have decided to bar electric tandems from races, since contests have been rendered uninteresting by their failure to operate. Of



Champion Elkes Paced by Petroleum Motor Tandem

course, on larger vehicles where lightness is not so essential the electric power acts very differently.

In America, as in Europe, it has been found that gasoline and petroleum motors are best suited for light vehicles. This country has always been well in the van where the use of steam was concerned, and the few steam motorcycles used here have met with fairly good success. One of them has covered the mile in one minute and nineteen seconds, the fastest ever made on a track, although a petroleum machine of American manufacture did the same distance over a straightway course near Boston in one minute and sixteen seconds.

The credit of introducing motorcycle racing in this country belongs to Henri Fournier, at one time the champion bicycle rider of France, and a motor cyclist of great daring. The manner in which he circled the little Madison Square Garden track last winter made him a great favorite with the public, and all during the racing season his work, on what he termed the "infernal machine," was greatly admired. At Asbury Park early in the spring he astonished the followers of this sport by operating his machine at the rate of one minute and a half per mile.

Although a number of impromptu motorcycle races occurred before this, the first real contest of machines in America took place at the Baltimore Coliseum in August. There were three

Petroleum Motor Quad. Steered by Caboillet, with Dudley Marks, Operator

Motor Cycle Racing

Motorcycle Paced Race at Manhattan Beach
Copyrighted by George Hare

crews on the motorcycles, and Fournier, with his mate, C. S. Henshaw, scored a victory after speeding around the saucer-shaped six-lap oval for a little more than twenty-four minutes, or an average of 1.37 for each of the fifteen miles. The race caused six sturdy athletes to face disaster and possible death over every inch of the journey. It was admitted, by men of uncommon *sang froid,* to have been the greatest cycling spectacle ever seen in America, and one fraught with a thrill of excitement that caused the four thousand spectators to follow every movement of the machines on their fearful journey. Wheel to wheel the racing tandems fairly flew around the oval, the seemingly nerveless men gripping the handle-bars while the motors sputtered at a wild rate—sounding not unlike firecrackers on the Fourth of July. The slightest turn of the front wheel, a pebble on the track, or the puncturing of a tire by a splinter from the board surface meant death or terrible injury. At the finish but a few feet separated the racers. It is such exciting incidents that fascinate a large class of Americans, and for that reason the sport sprang into favor at once.

Then came motorcycle contests on all the tracks of the East as well as contests between the middle distance champion bicy-

clists aided by those speedy pacing machines. At Manhattan Beach, New York, in the 100 mile race, Elkes and Pierce had a hard and even struggle up to 50 miles, after which the former could not stand the strain and Pierce came out a winner. The arrival of Caboiller and Marks, the former a famous French steersman and the latter the manager of Tom Linton, tended to increase the interest in the sport, especially when the pair paced Linton to victory over Harry Elkes, the American champion.

All in all the season ended with greatly increased interest in this style of competition. The final race at Manhattan Beach resulted in a victory for J. W. Judge, of New York, and Charles Miller, the six-day champion. The latter returned from abroad in the spring with a petroleum tandem of French manufacture and great power, which proved to be faster than the American product. In consequence the pair had no trouble in winning almost all the motorcycle races of the season. A different story may be told next season, however, when American manufacturers will have had more experience in building these speedy affairs.

How motorcycle racing of the future will be conducted can only be surmised. The high-banked tracks built for cycling cannot be used with safety at faster than a 1.25 pace, and the miles which have been covered by motorcycles in faster time were at the imminent risk of the lives of those manning the machines. It is not improbable that the future will see tracks banked as high as forty degrees around which the machines can rush at railroad speed—one mile in sixty seconds being considered nothing extraordinary—so that the two-wheel vehicles will appear to stand out almost horizontally from the speed course. Special tires that must be treated with ice-water to prevent their getting too hot, and fastened to the rims by various lugs and other appliances, will doubtless be a part of the future racing machines. Riders themselves, who would be unable to breathe while traveling at such a pace without protection, may be fitted with masks and other appliances, while wind shields to cut through space will be rigged in front of these virtual flying machines. Men who steer or operate them will require nerves of steel, while possible spectators who are subject to heart trouble may be refused admittance to the tracks where such exciting contests are conducted. There is every prospect of some thrilling sport with these miniature automobiles—if we might so term them—and contests may be witnessed in which human and artificial powers will be matched.

(To be followed by a Special Article on Automobile Races in our next number)

The Gordon Bennett Automobile Cup

THE conditions regulating competitions for this cup have now been issued by the Automobile Club of France, the present custodian of the trophy. The following is an official translation of these rules:

I.—All foreign automobile clubs recognized by the Automobile Club of France are entitled to challenge and compete against the club who holds the cup.

II.—The recognized clubs are: The Automobile Club of America, the Automobile Club of Austria, the Automobile Club of Belgium, the Automobile Club of Germany, the Automobile Club of Great Britain, the Automobile Club of Switzerland, the Automobile Club of Turin. Any club not appearing on this list and desirous of challenging will have to be unanimously accepted by the above clubs. Its name would then be added to the list to judge the validity of the subsequent challenges. It is nevertheless understood that on the proposition of one of the clubs to erase the name of another club this could be done if all the other clubs were unanimous.

III.—Any qualified club wishing to challenge the club holding the cup should give notice before the 1st of January of each year by registered letter addressed to the President, giving the number of automobiles which will compete for the cup. The amount of 3,000 francs should be deposited with the club holding the cup, this amount to be returned if one of the automobiles engaged is present at the start. The President of the Automobile Club of France should also be informed by a registered letter even if this club were not to be one of the competitors.

IV.—The cup can be competed for every year between May 15 and August 15. If two or more clubs of the same country were accepted in the list of challengers, it is understood that this country could only be represented by three automobiles at the most, and in such case the clubs of the said country would have to choose these automobiles. In case they could not agree, the automobiles would be chosen in order of entry. The exact date of the race to be fixed of a common accord between the clubs interested.

V.—Each club can be represented by one, two, or three automobiles at will, but the fact that only one or two automobiles of

a club should start cannot deter the other clubs from their right to have three cars to compete.

VI.—In case the club holding the cup should receive in time the challenge of several clubs, it could choose to hold one race only, in which each club would be represented by three automobiles at the most.

VII.—The automobiles qualified for these races are those coming under the description given in the Racing Rules of the Automobile Club of France, published in 1899, as follows:

> The automobile must weigh more than 400 kilos. and carry at least two passengers, seated side by side, of an average weight of 70 kilos. each, it being understood that in case the average weight should not reach 76 kilos. the deficiency would be made up by ballast.
>
> The 400 kilos. are counted for the weight of the automobile when empty, this being without passengers or supplies (such as coal, petroleum, water, accumulators), or tools, spare fittings, luggage, clothing, or provisions (Chap. I., Rule 9).

VIII.—The automobiles must be constructed entirely and in every part in the respective countries of the competitors.

IX.—The automobiles must be constructed by members of the competing clubs and the two seats occupied during the whole time of the race.

X.—Each automobile competing to send one delegate to form the Committee, Mr. Gordon Bennett to be member of this Committee and also the Automobile Club of France, even when not taking part in the race, to be represented by one delegate. The delegate to name a President, chosen outside of their own body, who, in case of the votes being equally divided, would have the casting vote. If they could not agree on the choice of a President, he would be named by Mr. Gordon Bennett, or, in his absence, by the President of the Automobile Club of France. The Committee to name, not necessarily from among themselves, a starter, a judge, and the timekeepers. The Committee to see that the rules are strictly adhered to and judge all the incidents which might take place.

XI.—The race, which would be a "go-as-you-please" race, without any stipulated stoppage, to take place on the road, and the distance to be from 550 kiloms. minimum to 650 kiloms. maximum. This distance to be chosen between two towns or apportioned into several outward and homeward journeys, but in the latter case the minimum distance of each part not to be less than 150 kiloms.

XII.—The race to take place in the country of the club holding the cup, with option for this club to hold it in France.

XIII.—The start to be given at the same time to all the automobiles, which would be placed in the following order: In front one of the automobiles belonging to the club holding the cup, then one automobile of each of the clubs taking part in the race, beginning by the club whose challenge was first received; after these automobiles, the second automobile of the holders, followed again in the same order by the second automobiles of the other clubs, and again after these the third automobiles in the same order.

XIV.—The automobile passing the post first to be declared the winner, entitling its club to the cup, even if it were the only automobile of this club to cover the full distance.

XV.—In case of a dead-heat between the club holder of the cup and one of the challengers the former would keep the cup.

XVI.—In case of a dead-heat between two of the challengers, these two clubs would have to race again together under the present rules before the expiration of two months from the date of the first race, it being understood that in such case the race could be held after the period fixed under Rule III. In case the two clubs could not agree on the choice of a road for the race, a draw would decide. If one of the clubs should refuse to take part in the second race, the other club would, *ipso facto,* take the cup.

XVII.—The cup to be left with the previous holder until the two clubs who have made the dead-heat meet again.

XVIII.—In the event of one of the clubs who had challenged being alone represented at the start, one of his automobiles would have to cover the distance stipulated in the maximum time of 24 hours, failing which the cup would be kept by the club challenged.

XIX.—It is understood that no club can ever become owner of the cup, but only hold it on the conditions fixed by the present rules.

XX.—Should the club holding the cup become extinct, the cup to be returned to Mr. Gordon Bennett, or in default to the Automobile Club of France.

XXI.—All races for the cup, either taking place in France or in any other country, to be run under the racing rules of the Automobile Club of France, published in 1899.

XXII.—Any club becoming holder of the cup, or challenging for it, undertakes to abide absolutely by the present rules and also by the rules of the Automobile Club of France on road racing, published in 1899.

Gallery of American Automobiles

Riker Electric Cabriolet

Riker Hotel Bus

Gallery of American Automobiles

Graut Bros.' Hydrocarbon Trap

Electric Vehicle Company Coupé

A Simple Steering Device

A PATENT on a new steering connection has just been issued to R. W. Jamieson, of Rochester. The object of this device is to cause the individual steering wheels to turn about their vertical axes in the centre of the wheels, and to overcome the jiggering action of the steering lever, which is a result with other forms of steering connections.

When the wheel encounters an obstruction, head-on, the tendency of the short stud axle is to turn about its connection, but this action in this device is entirely overcome, as the arc-shaped bearing members act as a locking device, and entirely prevents the wheels from turning out of their natural course, and overcomes the whipping of the lever from the hand, when rough obstructions are encountered.

This device has been thoroughly tested on a steam automobile, a photograph of which is herewith reproduced.

The Automobile Section at the Paris Exposition

M. JEANTAUD recently laid before the proper committee of the Paris Exhibition of 1900 his elaborated programme for a series of competitions, races and *fêtes* to be organized this year in connection with the automobile section of the Exhibition. This section will be held at Vincennes, as the space available at the Champ de Mars would be quite inadequate for the requirements of the new industry. The programme, including a budget of estimated expenditure and receipts, was unanimously adopted by the committee, whose official report it thus became. It was then read to the members of the Committee of the Automobile Club, who decided to accept the organization of the programme as provided for in the report, but only on condition that the directorate of the Exhibition do not modify in any way the figures set out in the budget, and that the credit of £5,000, as required by M. Jeantaud, is duly made. The programme, as will be seen, comprises competitions for all classes of automobiles, and should prove one of the most attractive features of next year's exhibition. Briefly summarized, it provides for the following events: In the month of May—A competition for touring cars, consisting of daily trials of 150 kilomètres during five days. The speed will not be permitted to exceed twenty kilomètres per hour in towns and villages and thirty kilomètres per hour in the open country. The points governing the trials will be: (1) Consumption of fuel; (2) action of motor; (3) comfort of vehicle; (4) facility of steering. The competitors will be divided into four categories: (1)Cars of two seats, weighing more than 400 kilos; (2) cars of four seats; (3)cars of six seats; (4) cars of more than six seats.

In the month of June—A competition for cabs and delivery vehicles carrying loads up to 1,200 kilos. Five daily trials during one week, the distance per day being 60 kilomètres in Paris.

In the month of July—A race for all these vehicles, divided into three categories, which are defined in the Automobile Club's racing rules of 1899. During one week, Thursday excepted, five races of from 300 to 400 kilomètres each will be run. Starting from the enclosure at Vincennes the vehicles will promenade to Joinville, from which place they will commence to race. On the return they will be timed at Joinville, and will then proceed to Vincennes and promenade twice round the Daumesnil track. Particulars of their movements during the races will be exhibited at the track by means of semaphores, etc.

In the month of August—A competition for voiturettes not weighing more than 400 kilos, and carrying two persons either side by side or tandem. The same programme as that for the touring cars.

In the month of September—A competition for light delivery vehicles carrying a maximum load of 100 kilos. The same programme as that for the cabs.

In the month of October—A competition for heavy vehicles coming under the following categories: (1) Vehicles for the transport of passengers; (2) vehicles carrying merchandise weighing more than one ton; (3) vehicles carrying a minimum load of 1,250 kilos. The trials will consist of five daily runs of 50 kilomètres each, starting from and returning to Vincennes.

In addition to these competitions there will take place on the track surrounding the lake Daumesnil, in the Bois de Vincennes, a series of sixteen automobile *fêtes,* comprising races and gymkhana events. Competitions for decorated cars will also be held, and toward the end of October all the competitors in the various events will process from the Exhibition to the Automobile Club's villa in the Bois de Boulogne, returning to Vincennes the same day. This should prove to be a most interesting sight, as every type of touring and racing cars, cabs, voiturettes, cycles and transport automobiles will be represented.

Every provision will be made to enable exhibitors to demonstrate their vehicles, and a special track will be constructed for the running of those cars unprovided with pneumatic or rubber tires.

The estimate of expenditure as provided for in Monsieur Jeantaud's budget is about $40,000, while the receipts are calculated at about $15,000, showing a deficit in round figures of $25,000. These figures, of course, only relate to the programme of *fêtes* and races, and do not refer to the Exhibition itself.

The opinion generally expressed is that the report is a truly excellent one, and should tend to make the automobile section of the Exhibition one of the most interesting features of next year's show. The attractiveness of the programme has gone far to dispel any fear which may have been entertained by some automobile manufacturers that the distance of Vincennes from the site of the Exhibition proper would be detrimental to the attendance of visitors. The opportunity afforded of almost daily witnessing the speed of the fleetest vehicles in their respective classes will assuredly be welcomed by next year's visitors to Paris, and once at Vincennes they will give plenty of attention to the manufacturers' latest productions.

The Automobile Club of Great Britain

By a Founder Member

OUR classical scholars were righteously indignant when it was decided to call it the "Automobile" Club. "Why," said they, "should we adopt this wretched mongrel word, a horrible mixture of French and Latin? Is it because the French have been guilty of burdening the industry with such an abomination that we should perpetuate it?" But there were

others, and those others were in the majority, who said: "To the winds with derivations! Let us bear the same name as our big brother 'the Automobile Club de France!'"—and we do.

At the end of 1897 a Mr. Frederick Simms suggested the formation of the Club and guaranteed its preliminary expenses. He is now one of the Vice-Chairmen.

The Hon. Evelyn Ellis, who was the first man to introduce a motor carriage into England, became the other Vice-Chairman, and Mr. Roger W. Wallace, Queen's Counsel, the Chairman. The Presidency remains unfilled, for the Club has a hope that some day the first gentleman in Europe will be pleased to give it his patronage. A Committee was formed of noblemen and gentlemen who were interested in the movement, and of representa-

The Club Office

tives of the chief automobile manufacturers. Rules were framed, the guiding principle of which was that the Club should not promote the interests of or be connected with any particular firm, company or commercial undertaking, but that its purpose should be the general advancement of the motor cause.

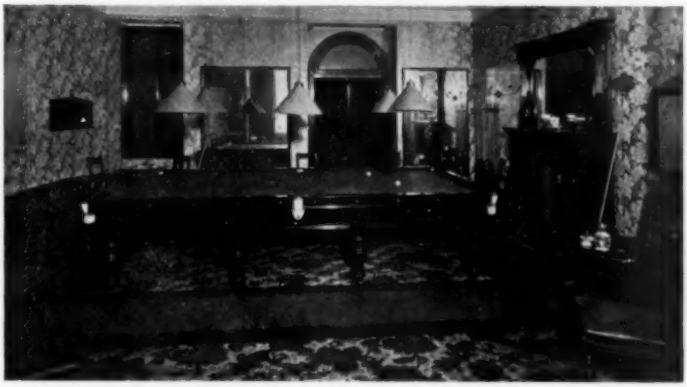
It was difficult at first to persuade people that the Club was pure, for there was in existence a so-called "Motor Car Club," which was, as the "Automotor" neatly put it, "a commercial adjunct" to a group of company promoters. Gradually, however, the government authorities began to recognize that the Club was not connected with finance. There was in existence previous to the formation of the Club an excellent institution bearing the unfortunate name of the Self Propelled Traffic

Association, presided over by Sir David Salomans, Bart., a gentleman who had been largely instrumental in the passing of the Light Locomotives Act, which gave motorists their rights. They did much useful work by holding trials of the heavier motor vehicles intended for commercial transport. In July, 1898, this association amalgamated with the new club.

The history of the first year of the Club's existence may be of interest to American automobilists, since their Club is only recently formed.

The year 1898 was marked by continuous activity. In the winter season there were discussions and lectures, including the following subjects:

The best means of promoting the utility of the Automobile Club.



The Billiard Room

The bearing of past invention on future motor car design.
Motor car machinery.
Motor touring at home and abroad.
The practical working of the Benz Motor.

In the summer there were club runs and tours:

At Easter there was a tour by Guilford, Winchester, Chichester, Littlehampton, Worthing, Brighton, Tunbridge Wells and Sevenoaks, a distance of 221 miles.

The Whitsuntide Tour was by Hertford, Cambridge, Newmarket, Norwich, Cromer, Ipswich, Colchester, Chelmsford. The tour occupied five days and comprised 330 miles. And again in the autumn there was a third tour by Maidstone, Rye, Hastings, Eastbourne, Tunbridge Wells and London.

There were frequent one-day runs. The Club had special enclosures at Henley Regatta, at Sandown Park Race Course, and elsewhere. There were garden and houseboat parties given in its honor. These Club runs and tours were very delightful. The main roads of England are crowded with historical and romantic associations and were explored by many members for the first time by means of the tours. Members brought their wives, and very festive, indeed, were the Club dinners at country hotels where sixty or more sat down to dinner of an evening and recounted the strange experiences of these delightful days. Episodes occurred then, when all were learners, which can never occur again in such number and variety, and they are the cause of many a hearty laugh now. How well the afternoon is remem-

Lounging Room

bered when a popular member of the Club was outside the Club door for two hours trying to start his Benz, and after pulling his machine almost to pieces, it was found that the cause of his difficulty was that his *oil-can was touching an electric wire,* hence, he had no spark in his cylinder!

At the beginning of 1898 there were 163 members, at the end there were 380 (an increase of 217); in November, 1899, there are 541, an increase of 161 since the 1st of January last.

In order to meet the extraordinary expenditure connected with the organization of the Club a Guarantee Fund was formed, to which members generously subscribed.

In the winter house dinners are held monthly. Recently the Second Annual Dinner has been held. Nearly two hundred

guests sat down, and among the speakers were the Hon. G. Shaw Lefevre, M. P.; the Hon. John Scott Montagu, M. P.; Lord Ampthill; Major Holden, and others.

This year, 1899, the Club has undertaken much important work. In addition to its tours it held, in June, official trials of vehicles on a course of 50 miles and on a steep up-gradient. The result of these trials has recently been published in an interesting volume.

In June the Club held an exhibition of motor vehicles, which lasted a week, and undoubtedly gave great stimulus to the industry. It is now holding a series of 100-mile trials, and is organizing another exhibition and a 1,000-mile trial from London to Edinburgh and back, with one-day exhibitions at 9 big provincial cities during the course of the trial.

There is a Club journal issued to members free once a week.

A glance at a programme recently issued by the Committee of the work it has in hand, will perhaps give the best idea of what the British Club is about.

The Committee have now under consideration the following matters. Special Committees will meet and press forward with these matters.

1. Recommendations to the Local Government Board as to amendments in the Regulations of the Board affecting Light Locomotives on Highways.
2. The formation of a Society for protection against vexatious prosecutions and vexatious actions at law.
3. The organization of a race for touring and racing carriages in France next spring.
4. The organization of the Second Automobile Club Show, to be held from or about 24th March to 7th April next.
5. The framing of Rules affecting Automobile Racing.

   NOTE.—At the last meeting between the Racing Rules Committee of the Club and the representatives of the National Cyclists' Union, highly satisfactory advance was made toward a settlement of this matter.
6. The representation of British manufacturers at the *Paris Exhibition of 1900, and at other Exhibitions.

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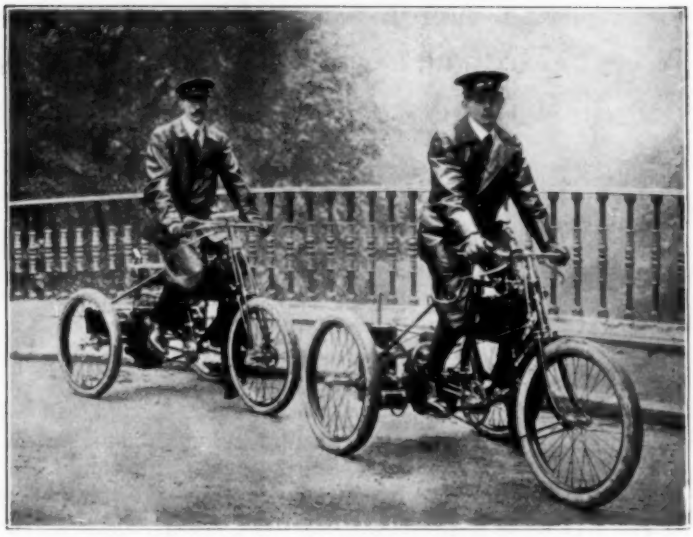
* The Automobile Club of Great Britain has, at the request of the Royal Commission for the British Section of the Paris Exhibition of 1900, agreed to co-operate and act as the Advisory Body in respect to the British Automobile Section.

7. Arrangements for the accommodation of Members of the Club who may be visiting the Paris Exhibition of 1900. It is proposed to rent a small villa near Paris.
8. The compilation of an accurate list of Motor-spirit Stores, Repairing Firms, etc.
9. The compilation of a small Pocket Book giving useful information of a non-technical nature.
10. Arrangements whereby manufacturers or Members may, at any time, submit motor vehicles to trial, and obtain a Club certificate as to their capabilities.
11. The formation of Branches of the Club in Scotland, in Ireland, and the provinces.

The comfortable premises occupied by the Club are at Whitehall Court, London, but members are looking forward to having in London, at no distant date, a house nearly if not quite as magnificent as the palatial abode of the Automobile Club de France.

The qualification for membership is not so very strict, as far as social status is concerned. Speaking broadly, cycle agents and professional cyclists would not be admitted as members, but automobile manufacturers and the better class of authorized agents of automobile manufacturers can become members of the Club. On the other hand, there is a sporting element consisting of many well-known members of the Royal Yacht Squadron, Masters of Fox-hounds and other sporting men, well known shots, etc., who have become enamored of automobilism. The Duke of Newcastle, the Marquis of Anglesey, the Earl of Carnarvon, the Earl of Shrewsbury and Talbot, Earl Russell, Lord Robert Cecil (son of the Marquis of Salisbury), General Sir Arthur Ellis (for years an equerry to H. R. H. the Prince of Wales), Lord Suffield (Master of the Horse to the Prince of Wales), and other noblemen, are members of the Club. The Club is recognized by and has reciprocal relations with the Automobile Clubs of France, Belgium, Switzerland and Austria, and hopes soon to have similar relations with the Automobile Clubs of Germany, Italy, and last, but not least, the Automobile Club of America.



Messrs. Hugo de Bathe and Moffat in Racing Rig

The New Sport Abroad

By Our Own Correspondent

THE Automobile Club of France is giving much attention to the arrangements for the contest for the International Challenge Cup to be held next year, some time between May 15 and August 15. This is to be an annual event, and limited to recognized clubs. At present there are eight: those of France, Great Britain, the United States, Germany, Austria, Belgium, Switzerland and Turin. The Belgian club is the first to send notice of its intention to enter the contest. The course will have a length, according to the final draft of the rules recently made, of between 544 and 640 kilometers by road, or 340 to 400 miles. The first contest will naturally be held in this country, but after that the defending club will have the option of deciding whether it shall be held in its own country or in France, which, with its universally good roads, offers the most favorable conditions for such a race. Should the cup go to Germany, Great Britain, or Italy, a good course could easily be found in those countries. I fancy, however, that it would be difficult at present to find in the United States 340 consecutive miles of good roads adapted to automobile purposes, although I should say that it will not be long before such a route could easily be mapped out in

either of your two States of Massachusetts or New Jersey, where great progress has been made in road-building, I am informed. So, should the cup go to your country at the start, as it will be quite likely to, if we may judge from the American record in yachting, bicycling and other matters, I suppose the contest would be held in France the next year—unless, with the supreme audacity of your countrymen in carrying out huge projects, it should be determined to construct a system of perfect highways expressly for the purpose! Should the Belgian club be the winner it could also hold the race in its own country, for little Belgium is full of good roads, though the course would have to be pretty labyrinthian to keep it within the national confines! But fancy Switzerland the winner and holding the contest among the Alps! The roads are undeniably good in Switzerland, but with the curves and gradients there obtaining it would be a contest of skill rather than speed, and the hazard would not be slight.

According to the rules each club may enter three vehicles. The net weight must not be more than 880 pounds—that is, without reckoning the weight of accumulators, fuel, water, petroleum, or luggage of any kind. Each vehicle must be driven by a member of the club that enters it and must also carry another person. The start will be given simultaneously to all the contestants. The cup will go to the club whose colors are carried by the winning vehicle, but will never become the permanent property of the winner. Challenges must be sent to the defending club before January in each year, and a deposit of $700 made, to be refunded at the start. All participating clubs will share equally the expenses of each contest.

A sign of the times is the action of the swell bicycle club of Paris, the Rallye-Velo, in taking up the automobile and building an automobile stable in connection with its club-house in the Rue de Chatres. This example has been followed by the Bicycle Club of Vienna. The enormous growth of automobile interests here in Paris is manifest in the fact that the Automobile Club proposes to celebrate the admission of its two thousandth member with a monster festival. As the membership is now 1,967 the affair may be looked for in the near future.

The growth has, indeed, become so great, that at last there is serious talk of restrictive measures. It is notable that, while restriction is attempted at the outset in your American cities, here the agitation has not arisen until there is something to restrict. Reckless speed, noise, and the undue crowding of the parks are all subjects of complaint, and the municipal council has taken the matter in hand. A committee of the council, appointed to con-

sider the subject, finds that the main purpose of the parks—that of providing the public with opportunities to seek quiet and escape from the confusion of the city amidst pleasant rural scenes, is interfered with by the manner in which some automobiles go tearing through the Bois de Boulogne and other pleasure-grounds, has reported in favor of restricting this use in various ways. It is therefore proposed to confine automobiles to the regular carriage roads in the Bois and in Vincennes, excluding them rigorously from the Pré Catelan, which is a popular resort for children, and from all the cross allées and wood paths, while on the Allée de Longchamps they would not be allowed between one and seven o'clock in the afternoon. Moreover, speed in any part of the city must not exceed 15 kilometers an hour, and in crowded or narrow thoroughfares it must not exceed the walking-rate. There has, indeed, been much recklessness of late, and accidents have grown too numerous. The best automobilists admit this, and agree that there is a necessity for judicious restriction. The Automobile Club proposes to lend its influence toward bringing to an end the abuses that have sprung up, though it contends that the restriction of the speed limit to 15 kilometers is too low for the outlying parks.

The noise of the exhaust made by many motor-cycles is another source of complaint. This is something that can easily be remedied, and would not exist to-day except for carelessness.

The Automobile Club has honored M. Meyan with its grand medal of bronze for organizing the Tour de France. M. René de Knyff has sold the voiture with which he won the Tour de France for the enormous sum of 66,000 francs. This indicates that a famous winning automobile has a value equivalent to that of a famous winning horse!

Imperial Russia was in evidence for the automobile on a recent morning in the Bois de Boulogne, when a landau containing the Grand Duke Alexis, Prince Sergius Galitzine, and MM. Zouroff, Potemkin and Heilmann made its appearance in tow of a Heilmann motor. The entire imperial family, with the exception of the Czar, is said to be devoted to the automobile. No wonder President Loubet prefers Count Pototsky's automobile to the erstwhile gala coach of the French Chief Magistrate. Speaking of Russia, it is of interest to state that an automobile omnibus route is to be established in the Caucasus, between Choucha and Khan Bagin, M. Charron having just sent to Tiflis a 12 horse-power Panhard-Levassor vehicle for the purpose. The Sultan of Morocco has recently ordered an automobile of the same make, with a motor of 7½ horse-power.

The number of automobiles in Paris on November 1, according to the official registration, was 1,795. So rapid is the increase that the beginning of the new year will probably see the number increased to at least 2,000.

A novel event that took place here late in October was the first automobile wedding—that of M. Richard Dupont and Mlle. Jeanne Constant at the church of Saint-Germain l'Auxerroix. The entire party appeared at the church portals in 20 brand-new automobiles, the bridal carriage elaborately decorated with chrysanthemums and ferns.

A notable automobile tour is that recently made by the Countess Corsini Sforza, from Paris to Rome and Naples. The route lay through Morvan, Lyons, Nimes and Marseilles; thence over the Corniche to Genoa, and through Florence and Perugia. The vehicle was an 8 horse-power Peugeot.

I hear from Nice that your compatriots, Mr. and Mrs. William K. Vanderbilt, Jr., have arrived there in their automobile and are enjoying delightful trips along the Riviera. Probably by the time these lines appear they will be in Egypt enjoying the novelty of automobiling about the Pyramids.

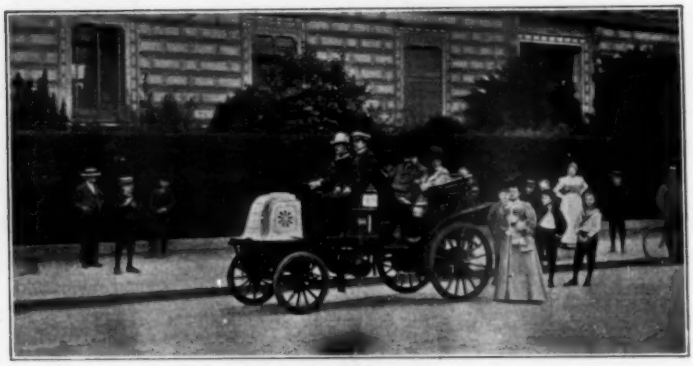
You will soon have a visit from our eminent inventor M. Serpollet, who has made the greatest advances in bringing the steam automobile to the present high degree of practicability. The Gardner-Serpollet is the name of the system which includes M. Serpollet's inventions. Your countryman, Mr. Frank Gardner, is the senior member of the firm. While not so much has been said about steam as about other forms of motive-power in automobile work, it has really made great strides here and is particularly in demand for omnibus purposes, wagons, and other forms of the heavier traction vehicles. The extent of the demand for such vehicles may be inferred from the fact that the Gardner-Serpollet house has under consideration two contracts for 500 vehicles each—one from the post-office, for mail-wagons to be used here in Paris, and one from Bordeaux. Good methods of filling large orders do not appear to be understood in this country, and our mechanics find it difficult to adapt themselves to it. Mr. Gardner says that his factory can turn out only 150 vehicles, but by having the parts manufactured in the United States the same number of men can put out 500 in the same time. A very large business will naturally be done between France and the United States in this way, and your automobile export trade will inevitably enormously promote American industry. Your light, graceful, and beautifully made American work is already in high favor here. The absence of demand in

your country, when your first concerns to undertake automobile manufacturing were engaged in their pioneer work, led the makers to seek a market here, where even then the demand far exceeded the supply. That made us acquainted with the quality of American work and it has come to be well appreciated. So, although your manufacturers are now overwhelmed with home

Winter Auto Costume

orders, they would do well to cultivate the foreign market that is eager for their products.

You are doubtless aware that the first prize, the gold medal, at the Berlin Automobile Exhibition, was awarded to the house of de Dietrich & Co., for its remarkably rich exhibit, which included a wide range of types, such as the "Spider," "Petit Duc," phaeton, omnibus, hunting, touring and racing vehicles.



A Berlin Texameter Droschke

Since the firm belongs in Niederbronn, Alsace, Frenchmen feel a sort of satisfaction in the result. The head of the firm, Baron de Dietrich, has won many contests in his own automobile. Two of the Dietrich vehicles, a phaeton of six and a break of nine horse-power, made the trip from Paris to St. Petersburg, by way of Berlin, without accident, and three ladies, Mme. Thevin, Mme. Houry, and Mlle. Houry, were of the party. In another Dietrich vehicle Dr. von Stern and his wife, of Vienna, made the journey from that capital to Paris and back to Salzburg, and a second journey from St. Gilgen, near Salzburg, to Berlin, to visit the automobile exhibition, and return. Last summer, on August 6, Dr. von Stern and his wife went in the same vehicle over the highest Alpine pass, the Stilfserjoch, 2,700 metres above the sea.

In Berlin, Herr Thien, who has long been prominent in local transportation interests, has begun a new motor-cab service. The pleasing German name of these vehicles is "automobiletexameterdroschken." The pictures that I have seen show them to be remarkably handsome and graceful carriages, despite their cumbersome name. This name, preposterous as it may sound, does not come up to the Flemish word for automobile, which reads, "Snelpaardelooszoonderspoorwegpetroolrijluig." In summer they have a half-top that is thrown back in the usual fashion, while in winter the carriage is entirely closed in as a coupé. It is driven by a "Phœnix" Daimler motor. It is adjusted to four speeds. In the city the rate is limited by police-regulation to 14 kilometers an hour, or about 8¾ miles. Even at the highest speed it can instantly be brought to a stop. The

designation of the first of these cabs to begin service, "No. 8941," indicates that in Berlin but little short of 9,000 cabs drawn by horses will be replaced by motor-vehicles in the course of a few years. And, as motor-cabs will be more extensively patronized than those with animal-traction, in a degree commensurate with the popularity of electric tram-cars as compared with horse-cars in your country, by the time the substitution is completed there will doubtless be at least 15,000 motor-cabs, or droschkes, in the great German capital, beside the many motor-omnibuses. And when we consider the similar demands in Paris, London, Vienna, Rome, Madrid, and all the other cities of Europe, great and small, it may be seen that there is no likelihood of any dull times in the automobile industry during the present generation.

A curious use of the automobile in Berlin is for advertising purposes—motor-cycles with voitures running about the streets with placards and also with advertising legends on the backs of the driver and his companions.

The Vienna Bicycle Club, the oldest and largest in the city, has established an automobile section.

In Graz, the capital of the Austrian province of Steirmark, the Steirmärkischer Automobil-Club has been organized. Graz may be called the Austrian Dresden, having a large number of

German Advertising Motor

well-to-do persons of leisure, from all parts of Europe, among its residents, and the automobile naturally finds a great popularity there.

The following from a letter from Lady Jeune to the London *Telegraph,* after an automobile trip to Weston-super-Mare with her husband, Sir Francis Jeune, gives an English woman's views of the charms of motor-touring, as they call it in her country:

Lady Jeune, who, with Sir Francis Jeune, paid Weston-super-Mare a visit in a motor-car about three weeks ago, contributed an interesting article on Motor Touring to last Saturday's *Daily Telegraph.* Her ladyship says:

"There is no more delightful mode of seeing England than driving through it on a motor-car. The speed at which it goes enables one to visit a wider range of country than would be possible in a carriage. There is no road too hilly or too bad for it to undertake, and the speed can be regulated to whatever pace suits. Eighty miles a day is not too hard a task to set one's motor, and, unlike a horse, it goes better as the distance increases and the day wears apace, and it comes in almost discontented at being stopped at night-fall, for it works best in the cool evening air. There is no limit to the willingness of a motor. It never stops, it never flags, and its noise is a sort of song of anxiety, uncertainty and emulation. To the driver and those who appreciate it, it has almost the intelligence of a creature, while no higher tribute can be paid to its virtues and qualifications than the fact that by those who know it best it is always spoken of as 'she.'

"Automobilism is doing a great deal in the direction of increased health and enjoyment for us, but a hundred years hence, how shall we get about? We who are watching the birth and infancy of improved locomotion shall all then be sleeping after our long journeys here are over. But while we may, let us develop and popularize as much as we can any new power which enables the tired and hard-worked ones of the earth to get easily and quickly away into communion with Nature and the peace she bestows, which will lways be the greatest and most merciful of all her gifts." Certainly Lady Jeune's enthusiasm is great.

On November 15 the London Automobile Club held its fourth annual meet with a run to Brighton. About 50 vehicles participated. The start was from the Hotel Metropole and the route by way of Reigate, where luncheon was enjoyed at the White Hart Hotel. The procession through the Brighton streets was an imposing one. A banquet in the evening closed the ceremonies, the return the next day being informal.

An Artist's Appeal

By Frances S. Carlin

EVERY man and woman (particularly woman) who has ever sketched out of doors knows what weary work it is just to transport oneself and one's paraphernalia to the "point of view." The distance is often great and the very simplest kit heavy, and it really seems as if it were spelling Art with too big an A to attempt anything except from one's veranda or upper windows. But the prettiest little streams, the most picturesque old mills or inviting stretches of beach are always "Waal! about two mile further on," any other measure of distance being incomprehensible to the bucolic mind. And then the difficulties and discomforts so often incidental to sketching. The dusty road or wet grass to sit on. The havoc that a high wind will make of easel and umbrella; to say nothing of a wet canvas. The utter impossibility, sometimes, of finding even a crevice for the umbrella stick, amongst the rocks. The "no thoroughfare" that a willful cow can make of a shady lane. All these things are most trying to a would-be landscape painter.

The writer will never forget the two weary hours that devotion to art and a particularly pretty "bit" compelled her to spend, balanced on one foot on the bottom rail of an old fence. Paintbox and sketching block in one hand, pencil and brush in the other; her water pail hung on a convenient but rusty fragment of nail. And mosquitoes, with the unerring instinct that seizes an opportunity, holding high carnival. Or another time, when parasol, artist and camp stool had to be strapped together so that the masterpiece might be finished before the incoming tide swamped everything.

Some artists, Monet, for instance, more luxurious than their fellows, have a boy and a push-cart. We, in modest imitation, raked out of the garret of our French *pension* an old perambulator that served us many a good turn. Last summer we essayed a wheelbarrow, a most unruly steed, that balked up a hill and bolted

down. Some kind friends not in the profession suggest a horse and carriage. Well! in the first place, artists, as a rule, do not have horses and carriages at their command. And if they do, horses have to be unhitched and fed, a great waste of time with the light changing every minute. So, then, why not have an automobile, especially constructed for an artist's needs. Low and open in front like an invalid's chair, but with the seat wide enough for two for an occasional friendly spin. A parasol suspended from a hook, like a baby carriage. An easel adjustable to the brake. Places under the seat for color box and canvases. And the cost low enough to bring the trap within the means of the most impecunious artist. We do have so few pennies left after paying our landlords and frame makers.

As speed would be a secondary matter a low rate of horse-power would be sufficient, and the carriage could be very light and simple in construction, so that it could be trundled home in case of a breakdown. As a rule, artists are not practical mechanics, as are many of the present owners of automobiles. The motor of this artist's delight could be gasoline or kerosene, the smell of which is only offensive to the people behind in the road, and not any worse than some other team's dust. As the floor of the carriage would be only a foot or so from the ground an explosion or a runaway need not necessarily be fatal, but simply a little hastening of the exit, which brings me to the end of my description.

And now, good people of the automobile companies and Trusts, will you not make for us some such carriage as this? Think what the future of American Art would be, unhampered by conditions. Think of the undying gratitude of that vast body

of men and women, the artists of this country, of whom there are three thousand in New York City alone, and make for us a practical and reasonably economical Artists' Automobile.

A DISCERNING ANIMAL

That some horses should take affright at the uncanny appearance of their most formidable rival seems but natural, considering the highly excitable temperament of our four-footed friend. A new phenomenon, however, is a French horse which makes it its business to attack unsuspecting *chauffeurs*. This amiable beast lives at Cosne, and has already destroyed three automobiles. Its last victims were MM. Demay and Bossu, who were surprised by a sudden violent assault of the infuriated animal, which jumped into the carriage and proceeded to kick the whole machine into smithereens. When the two *chauffeurs* disentangled themselves from the ruins of their automobile, one had his leg broken, while the other had been kicked sprawling over the dashboard. After this slight diversion the horse gave an exhibition of speed on its own account.

Liquid Air

By Harrington Emerson

LIQUID air cannot have any commercial value for the production of either power or cold. A few elementary considerations will make this plain. One pound of coal can evaporate ten pounds of water. As it is converted into steam the water expands to about 1,700 times its volume as water. Ten pounds of liquid air expand to only 800 times the volume as liquid (under an increase of temperature up to sixty-five degrees Fahr.). It would therefore take 20 pounds of liquid air to yield the same power as can be obtained from one pound of coal. When 20 pounds of liquid air are as cheap as one pound of coal, then, and not before, liquid air can compete in cost. But even then it cannot rival coal. A piece of coal will keep almost indefinitely. A piece of anthracite coal could be carried from tropics to pole for a hundred years and without deteriorating. It would ever be ready to yield its stored energy. Who could keep a pound of liquid air even for twenty-four hours?

Weight for weight coal is twenty times as powerful, and a thousand times as durable. It is as yet a hundred times as cheap and a thousand times more easily taken care of.

Liquid air has little value as a commercial refrigerant. It shows intensity of cold but no volume. We do not attempt to heat our house with the arc light, yet its focus is the highest temperature known. It also has intensity, but no volume. Throw a quart of liquid air at a girl twenty feet away, and it is all dissipated before it reaches her, so that she scarcely feels coolness. A pound of ice in a refrigerator would cool it more than a pound of liquid air. Ice costs three dollars a ton, liquid air more nearly three dollars a pound, but were its cost but a cent a pound it would still be seven times dearer than ice. Even a small piece of ice, if wrapped in a blanket, will keep all night. A similar amount of liquid air, put in a can and that wrapped in the blanket, would disappear in a few minutes.

If under these elementary conditions liquid air cannot hold its own with either coal or ice, what chance would it have when violently used in a complicated machine?

Mechanical Propulsion and Traction

By Prof. G. Forestier

(Second Paper)

PROFESSOR OLIVIER, of the Ecole Centrale des Arts et Manufactures, in a recent report read at a session of the Société d'Encouragement, declared in 1840 that the problem of steam locomotion upon roads should, from the standpoint of mechanics, be considered as solved. This too optimistic opinion, as well as that of the *Constitutionnel* upon the carriage imported by Asda, should render us slightly skeptical as to the excellent results said to have been obtained by Goldsworthy, Gurney and Walter Hancock, who organized regular passenger services assured by steam carriages, of which the malignity of the railway companies alone caused the disappearance in 1836.*

*This opinion, greatly amplified in the second volume of *Vehicles Automobiles*, by M. Louis Lockert, is also that of Count de Chasseloup-Laubat in the *Poids lourds* of the official catalogue of the Exposition of Automobiles at Paris in 1898.

Yet, in a pamplet entitled "Voitures à Vapeur sur routes ordinaries," published by H. Fournié, Paris, 1835, the authors, Gaby-Cazalat and C. Muyaud, inventors and manufacturers of another vehicle, after remarking that the carriage imported in 1835 by Asda was, as regards mechanism, like that of Gurney, make the following declarations:

(1). The apparatus that produces, distributes and utilizes steam could not be applied with advantage to the service of ordinary streets until it has received fundamental improvements that the English have been unable to make.

(2). The disarrangements and disconnections of which the carriage imported by Asda gave examples, and which resulted from the vicious conception and vicious arrangement of the mechanism, prevent all continuous locomotion, even in a transportation of slight extent.

(3). Finally, the expenses occasioned on the one hand by the disarrangements and disconnections, and on the other, by the great loss of coal and power, due to the vicious construction of such engines, robs them of all chance of success, since, even though no frequent interruptions in running were to be feared, they would not fulfill the first of the conditions, without which there is no success possible —economy.

Coming from a competitor, such criticisms might seem to be exaggerated; but the fact must not be lost sight of that the object of the pamphlet cited was to answer the criticisms of the *National* and *Les Debats* formulated against the Gaby-Cazalat and C. Muyaud carriages in taking as a basis the accidents that happened to the Asda or Gurney carriage.

On page 23 of an English work, entitled "Motor Cars or Power-carriages on Common Roads," by A. J. Wallis-Taylor, C. E., we find a reflection of the opinion of MM. Lockert and Chasseloup Laubat in these words: "Steam carriages constructed by these inventors (Gurney and Hancock) were run for some time in different parts of England and Scotland, *with considerable success as far as the mechanism was concerned*, but failed to prove profitable as commercial undertakings, chiefly, no doubt, owing to the *heavy tolls* which were levied upon them, and to the obstructions that were everywhere thrown in their way, their very success as practical mechanical contrivances having raised up a horde of enemies against them." On page 27, on the contrary, we read: "*Internal discussions and disputes* occurring among the members of the company that had been formed to work these steam engines resulted, however, in the stoppage of the undertaking."

Moreover, if we refer to the conclusions of the jury on tests of the Liverpool competition of 1898, we shall see that even in the present state of the somewhat too light construction resulting from the legal prescriptions in England, the material is still exposed to frequent interruptions of service that are as onerous as they are unfortunate.

The reflections of the departmental engineer-delegates to the Competition of Heavy Weights at Versailles in 1898, only too fully justify the heavy tolls imposed upon power carriages by the corporations whose business it is to keep the roads in repair.

However this may be, the following are a few data as to the conditions under which the English carriages were constructed in 1832.

At the outset Gurney employed a steam traction carriage of which the principal arrangements are shown in Figs. 6 and 7.

The driving wheels were in the rear and their cranked axle was connected directly with the rods of the pistons placed in front of the carriage. Arms keyed upon the extremities of this axle

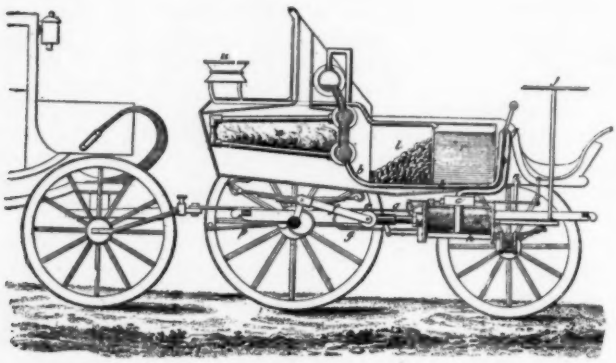


Fig. 6. Vertical Section of Gurney's Steam Carriage.

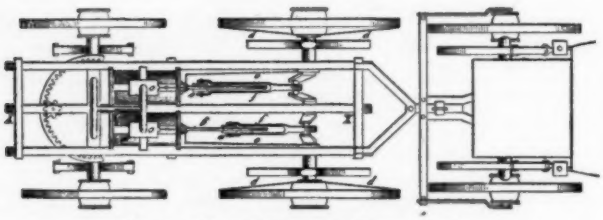


Fig. 7. Plan of Gurney's Steam Carriage

acted upon the fellies of the wheels. In turning about it was possible to act upon the springs that held these arms and to cause the action of the arms that carried along the interior wheel to cease.

In this first carriage the steering was done through a pinion that acted upon the toothed sector of the fore-carriage, which was movable around a king-bolt. In his subsequent experiments Gurney discarded the traction-carriage and replaced the method

of steering by a three-wheeled bogie fore-carriage. The proper motions of this fore-carriage were obtained by the driver through the intermedium of a lever that acted upon the front wheel, which was placed at the end of a pole fixed at right angles with the axle of the fore-carriage properly so-called. This somewhat complicated arrangement must have given, and, in fact, often did give, rise to disarrangements.

Hancock's first carriage was a tricycle, of which the front wheel was both a driving and steering one. In the following ones (Fig. 8) the hind axle was the driver and was connected through a chain with a wheel actuated by the connecting rod of a piston.

The steering fore-carriage was movable around a king-bolt. The driver acted upon this fore-carriage through the intermedium of a steering bar mounted upon a vertical rod, which, beneath the floor, carried a pinion connected through a chain with a toothed sector mounted upon the fore-carriage. The pictures

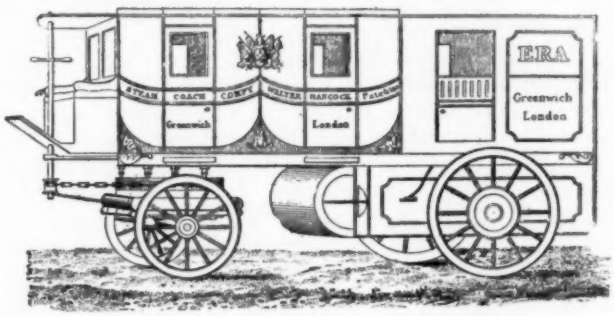


Fig. 8. Hancock's Steam Carriage

of this carriage give us the impression that it was a heavy and pretty badly arranged vehicle.

The automobile carriage for passengers and the automobile truck have been neglected by inventors in France, where particular attention seems to have been paid to the road locomotive.

As long ago as 1856 the Lotz establishment, of Nantes, acquired a well deserved reputation for its agricultural road locomotive, designed to perform the double role of a motor for actuating threshing machines, plows, etc., and a traction engine for hauling such machines from the farm-house to the field and from one field to another, etc. In the first type the steering fore-

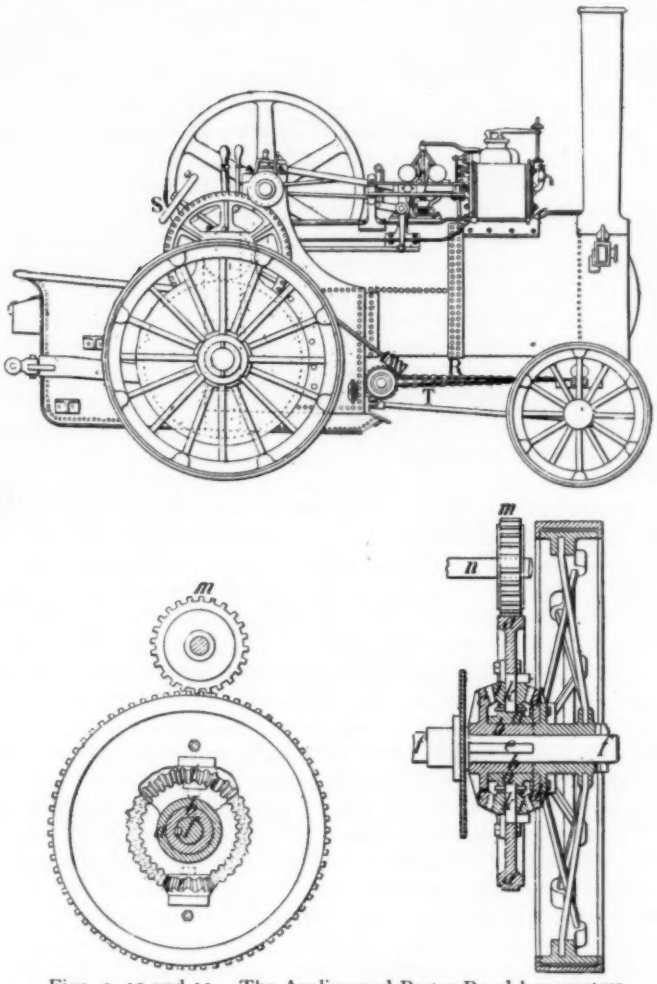
carriage, which was two-wheeled, was maneuvered through a chain set in motion by a hand wheel actuated by the engineer standing in the rear, as in the present compressing rollers.

In 1865 M. Lotz, with a view to rendering his road locomotives particularly adapted for hauling upon canals, patented a method of steering through a single wheel placed in front and in the centre of a horizontal face-wheel. This latter was actuated by a pinion mounted at the bottom of a vertical rod, at the top of which was fixed a pinion with helicoidal toothing that geared with the endless screw of the shaft of a vertical rudder wheel. The results obtained with these road locomotives were such that many thought that herein was to be found a solution of the question of cheap transportation upon roads. The requests for permission to run road trains reached the Administration in so large numbers that the latter thought it necessary, on the 30th of April, 1866, to address to the Prefects a ministerial decree designed to regulate matters concerning the new method of transportation.

Although more particularly devoted to the manufacture of traction engines, M. Lotz has nevertheless produced a genuine passenger steam carriage, provided with a single steering wheel in front, and in which is found the general arrangement that has finally become prevalent. In this vehicle the engine and vertical boiler were placed in front in a sort of semicircular fore-body supported by the steering wheel. The engineer, standing between the motive gear and the passenger compartment, had within reach of his hand all that was necessary for the management of the engine and furnace as well as for the steering of the carriage. Motion was transmitted to the rear driving wheels through a chain.

While recognizing the fact that road locomotives have rendered and are capable of still rendering services in a few very special cases, we shall not dwell upon the different types of engines of this kind that have successively been put in service. Nevertheless we shall mention the Thomson road locomotive (constructed at Edinburgh in 1869), because it is the first vehicle of the kind in which, to our knowledge, vulcanized rubber tires were used for the driving wheels, as well as for those of the steering fore-carriage. The good effect of these was such that Thomson was able to *dispense with the interposition of springs between the axles and the carriage frame.*

We give, too, figures of the English road locomotive of Aveling and Porter, because they show the application of the Pecqueur satellite gearing to the transmission of the motion of the motor to the driving wheels (Figs. 9, 10 and 11).



Figs. 9, 10 and 11. The Aveling and Porter Road Locomotive

R, chain for setting the steering axle in motion; S, crank for setting in motion the endless screw that actuates the pulley placed under the boiler, and around which wind the extremities of the chain R; T, iron rod for strengthening the fore-carriage; *m*, a pinion keyed upon the driving shaft *n*; *d*, toothed wheel loose upon the axle *f*; *ii*, gearing mounted upon the spokes *k* of the wheel *a* and transmitting the motion of the latter to the bevel wheels *dd*, which are fixed to one of the driving wheels loose upon the axle *fcc*. At the other extremity of the axle *f* is keyed the other driving wheel.

In France Baron Seguier, in a study of mechanical vehicles, in 1866 put forth the idea that it would be well to render the driving wheels independent and actuate each of them by a sepa-

rate motor. He judged that it would be easy to co-ordinate the motions of these two motors in such a way as to give each of the wheels the motion adapted for obtaining the direction that might be desired. This idea was carried out by Michaux in 1870.

In France the automobile carriage for passengers was taken up again about 1873 by Bollée, of Mans. The experiments of this manufacturer appear to us to be worthy of mention, because he claims the honor of having devised one of the steering arrangements by pivoted wheels having properly conjugated motions. The starting point of his invention, according to his patent of April 28, 1873, was as follows: Having remarked with what facility the Lotz three-wheeled road locomotive performed its evolutions, he was desirous that each of the two wheels of his fore-carriage should be capable of revolving around a vertical axis like the Lotz single front wheel. This arrangement became the starting point of one of the most widely used steering apparatus. We shall return to it in detail further along.

The rapid vaporizing boiler, which was of the Field system, was placed in the rear. The two-cylinder horizontal engine, placed in front and incased so as to protect it against dust, actuated a differential gearing mounted upon an intermediate shaft of which the extremities carried sprockets connected through chains with sprockets keyed to the hubs of the driving wheels.

We here bring to a close a historic resumé, of which the object has not been to study the different motors that have been successively utilized for mechanical propulsion, but solely to inquire into the conditions of construction proposed for the mechanically propelled road vehicle. We have, in fact, come to an automobile carriage which, to a still further degree than the Lotz steam carriage, is provided with all the parts necessary. In the following chapters we shall evidently have to mention many more improved arrangements of detail and to describe general arrangements that are preferable; but, upon the whole, we are in possession of a vehicle that realizes our desiderata: the possibility of transmitting simultaneously to each driving wheel that part of the power that is necessary to it, according to the resistance that is momentarily opposed to it; a steering apparatus of a sufficiently certain and rapid maneuver; a relatively light motor, and a boiler with rapid vaporization. The vehicle with which we have just closed our brief history may be applied either to the carriage of passengers or to the transportation of any merchandise in bulk that can be loaded upon any sort of truck.

Specially translated for the Automobile Magazine from *Le Génie Civil.*

(To be continued in our next issue.)

The Truth about Motor Horse-Powers

By Georgia Knap

DESPITE the honesty and the good faith of most manufacturers, the author of the present article knows beforehand that the following explanation of the horse-power of automobile motors will cause many of them to raise a general hue and cry of reprobation against him. To such he replies that the brake tests upon which he has based his exposition were made in the presence of many spectators; that they were recorded in a report signed by the experts in charge, and that the tests in question have been repeated several times under the best possible conditions of carburation, compression, etc.

"But," you will say, "what good is it to us if you have shown that most automobile motors do not develop the energy in horse-power claimed for them, provided they will drive a carriage or tricycle at the rate of twenty miles an hour on a level road and at a good speed on heavy grades? What difference does it make whether they be called four horse-power or eight horse-power motors?" Your argument is good, it must be admitted; but, on the other hand, this incorrect denomination, if you take it literally, will lead you to consequences which you hardly expect. Your motor, for a given piston area and stroke, should develop a certain horse-power; but when it is subjected to the brake test you will be astonished to find that it develops but half the supposed energy. Because a certain motor has the same diameter of cylinder, the same stroke as yours, and because it develops 4½ horse-power, therefore you conclude that your own motor should yield at least 4 horse-powers. And you will rack your brain because your motor develops only 2½ horse-powers; and you will work three months, six months, seeking the two missing horse-powers, changing every part—ignition tubes, carbureters, etc., but the result in the end will always be the same.

There is still another matter to be taken into account—the possibility of an action with your customer; for he may sue you because his motor does not yield the energy claimed for it at the time it was purchased. Recently a *chauffeur* conceived the idea of using his carriage motor for driving a dynamo to light his house. The dynamo required 2½ horse-powers under good con-

ditions; the motor—a water-jacketed engine—was rated at 3¾ horse-powers. When the two had been set up and properly connected the motor absolutely refused to start the dynamo. After a thousand vain attemps to generate a current, he finally decided to have his motor tested by some competent engineer, who found that it was capable of developing only one horse-power and a half. Perplexed, our *chauffeur* went to one of his friends and told him his woes.

" Your motor is out of order," the latter replied; " I have the same carriage and the same motor and mine almost runs away. But are you certain that your carbureter is good? Do you know that with good carburation you can double the horse-power of your motor?"

Unconvinced by these brilliant arguments, our *chauffeur* proposed to subject his friend's motor to the brake test. The result proved that, as in the first instance, the second motor likewise yielded only 1½ horse-powers. The two friends, now both enraged, promised each other to " make it warm " for the manufacturer. And nevertheless, up to that time neither had uttered a single complaint. The engine worked comparatively well; grades were ascended at a small speed, it is true, but still they were overcome. Nevertheless, a simple brake test demoralized the two *chauffeurs*.

If it be considered how large is the amount of work represented by a horse-power it should cause no astonishment to find that a horse-power and a half are sufficient to drive a 400 kilog. (880 pounds) carriage at the rate of 18 to 20 kilometres (11.18 to 12.42 miles) per hour on a level road, and at the rate of 8 to 10 kilometres (4.968 to 6.21 miles) on up-grades. In factories, two and three horse-power gas engines are often used to drive machine-tools on which eight and ten men are employed.

Tables given at the end of this article will show exactly what power is required to drive vehicles at speeds varying from 15 to 40 kilometres (9.3 to 24.84 miles) per hour. By referring to the data there collected and tabulated the *chauffeur* and the manufacturer can determine with reasonable accuracy the power of a motor, provided the weight and speed of the carriage be known. For a 150 kilog. (330 pounds) carriage, the weight of the passengers being included, a 1½ horse-power motor will be required to attain a speed of 25 kilometres (15.52 miles) per hour on a level road. For a *voiturette* weighing 300 kilog. (660 pounds), including two passengers, a motor of 1½-horse-powers will be necessary to cover 25 kilometres on a level road, and a 1.9 horse-power motor for a speed of 30 kilometres (18.63 miles).

For a two-seated carriage weighing 400 kilog. (880 pounds), passengers included, a 1.3 horse-power motor will be required for a speed of 20 kilometres (12.42 miles) per hour on a level road.

But since all these vehicles have changes of speed, it follows that the power need not be increased to ascend grades. Hence we shall find that if our 300 kilog. *voiturette* encounter a grade of 5c. per metre, our horse-power and a half will drive it up the ascent at a speed of 15 kilometres (9.315 miles) per hour. The 400 kilog. carriage will climb the same grade at about 10 kilometres (6.21 miles); for our table shows that to ascend a grade of 5c. per metre a 400 kilog. carriage with a speed of 15 kilometres will require a 1.9 horse-power motor; and since we have but 1.3 horse-powers at our disposal, a very small down-gearing will be necessary. Thus, with the speed-changing gear, grades can be climbed with a motor which would absolutely refuse to run if the speed of the vehicle were not reduced and to make the number of revolutions for which it was built. The tables referred to will be indispensable in calculating the dimensions of the parts of speed-changing gears so that these parts will correspond with the power of the motor. They will, furthermore, indicate what speeds can be attained for a vehicle of a given weight and for a grade of a given number of centimetres per metre. It will be a simple matter to calculate the required down-gearing from the data furnished by these tables. Thus, for example we find that a carriage weighing 650 kilog. (1,430 pounds), including the passengers, and driven by a 5 horse-power motor, will cover 35 kilometres (21.735 miles) on a level road. But if an up grade of 4 centimetres per metre be encountered, then the speed will fall to 24 or 25 kilometres (14.904 or 15.525 miles) per hour; for our table shows that in order to cover 25 kilometres in an hour on an up grade of 4 cent. per metre a 650 kilog. carriage will need a 5.2 horse-power motor. It is, therefore, required to ascertain the down-gearing desirable for a speed of 24 kilometres per hour without changing the number of revolutions of our motor. If the grade be still steeper, 7% for example, which is unusual, then our table shows that a 650 kilog. carriage, in order to ascend a 0.07 grade at a speed of 15 kilometres per hour, will require a motor of 3.9 or 4 horse-powers. There still remains a single horse-power at our disposal, but since it is possible that a heavier grade may be encountered, a grade of 9 or 10% for example (which is not rare in mountainous regions), it would be wise to retain our last speed of 15 kilometres per hour, unless we add a fourth speed of 12 kilometres per hour and change our 15 to 18. The calculation will therefore be reduced to a very simple expres-

sion and will enable us to arrange changes of speed with certainty and with every chance of success in our favor.

From the foregoing explanation it is evident that a considerably smaller power is required for automobile traction than is generally supposed. It will also be seen that most 4, 5, and 6 horse-power motors are overrated; and that if these horse-powers be really developed there will be a corresponding increase in speed.

For various loads on level roads a 3 horse-power motor should drive a carriage weighing 300 kilog., including the passengers, at a speed of 40 kilometres per hour, and force it up grades of 5 cent. per metre at the rate of 26 kilometres per hour. If it be considered how small is the passive resistance of the transmission gears in actual use on carriages the speed will evidently be inappreciably reduced.

Double-cylinder motors are usually rated at nearly their true horse-power; we say usually, for there are also exceptions to the rule. We have known double-cylinder motors rated at 6 horse-powers which actually developed the full power; but we have also known motors ostensibly of 10 horse-powers which hardly yielded 6. If the fever for overrating the energy of motors continue, manufacturers will soon sell us motors of 25 and 50 horse-powers.

THE BEST BRAKE TEST FOR AUTOMOBILE MOTORS.

The brake which we shall presently describe is undeniably the simplest and cheapest of its kind.

The Prony brake, well known to all motor makers, can readily be used for measuring the power of steam-engines, but when it is applied to a high-speed motor working with the irregularity and violence of an explosion-engine its use is accompanied by great difficulties; and good results are obtained only by the exercise of considerable care. The brake, during the test, must be constantly lubricated; soap suds are splashed in all directions, often covering the experimenters and rendering the manipulation of the apparatus extremely difficult. If the motor be abruptly stopped, the load is hurled forward, to the danger of those present. These are the disadvantages which have led to the invention of a rope-brake of such simplicity that it can be made by any one. The brake can be used alike for slow steam-engines, making 150 to 200 revolutions, and for electric motors, making 2,000 and 3,000 revolutions per minute.

The operation of the brake is as simple as its construction:

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Around the fly-wheel A of the motor a rope is passed, coated with graphite, to prevent overheating and to facilitate the operation. The rope is attached to a steelyard or preferably to a dynamometer. The dynamometer D is secured to a fixed point B, and to the other end of the rope a weight P is fastened.

When the motor is in operation, the weight P, by reason of the pull which it exerts, will give rise to a rubbing friction which will cause the rope to cling to the fly-wheel. The rope will, furthermore, tend to raise the weight. In order to measure the work it is therefore necessary to multiply the weight P by the circumferential velocity of the fly-wheel.

Let R be the radius of the fly-wheel and r the radius of the rope. The power of the motor will then be expressed by the formula:

$$T = \frac{\pi\ 2\ (R + r)\ n\ (P - p)}{60 \times 75}$$

Example—Given a motor developing $1\frac{1}{2}$ horse-powers at a speed of 1,200 revolutions, the diameter of the fly-wheel being 30 centimetres, let us suppose that the value of P is 8 kilogs., that of p, 1,200 kilogs., and the diameter of the rope 6 millimetres. The pull on the steelyard or dynamometer D will then be

$$T = \frac{2 \times 3.14 \times 0.153 \times 1200}{60 \times 75} \times 6.8 = 1.74 \text{ H. P. } (\textit{chevaux-vapeur}).$$

It is important that p be not neglected; for the value of P alone will give a power far greater than that actually possessed by the motor. In the foregoing example we should thus obtain 2.05 horse-powers instead of 1.74.*

When the experiment is at an end the motor should not be stopped by means of the brake still applied to the fly-wheel; for an abrupt stop would injure the steelyard or dynamometer. It is merely necessary to detach the dynamometer and the weight, allowing the rope to slide from the fly-wheel. Too many precautions cannot be taken; serious accidents may happen if the rope becomes coiled around the motor-shaft and the hook caught in the clothes of the experimenter.

In order to secure the yoke, I, to the rope, copper rivets are used, plaited in the strands.

The weight P should be gradually increased until the motor evidently works with an appreciable effort; but the load should never be so great that the motor either runs by starts or not at all. The weight P can be as heavy or as light as it may seem desirable,

* The *cheval vapeur* is equal to 0.9863 H. P., or almost equal to the English and American horse-power.—EDITOR.

the only limitations to be observed being those previously mentioned. If the motor have but a small weight to lift, it will turn more quickly than if the weight be heavier. In either case the value expressed in horse-powers will be the same.

It is important for the success of the test that a good speed indicator and an accurate chronometer be used, and that the experiment last at least fifteen minutes.

The tables which follow, as well as the formulæ upon which they are based, have been prepared by Messrs. Boramé and Julien,* and give the force exerted tangentially to the driving-wheel of an automobile and the work in horse-powers (*chevaux-vapeur*) developed, the calculation being based on the load (weight of the vehicle included), the grade and the speed. It will be evident from a cursory examination of these tables that the data there collected will considerably simplify the calculations of automobile-manufacturers. The table of forces will enable the dimensions of intermediate parts for the transmission of power to be readily figured; and the remaining tables will indicate the motive power required for a given vehicle.

Work in Horse-powers Developed During the Run of an Automobile

Calculations based on the load (weight of the carriage included), the grade, and the speed, independently of the passive resistance offered by the system of transmission adopted.

Speed of 15 Kilometres per Hour.

H. P. — French *cheval-vapeur*, 0.9863 H. P.

Grades.	Loads Pulled, Weight of Vehicle Included.											
	300	400	500	650	800	1000	1250	1500	1750	2000	2500	3000
	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.
0m.00	0.6	0.8	1.1	1.3	1.6	2.0	2.5	3.0	3.5	4.0	5.0	6.1
0.01	0.8	1.1	1.3	1.7	2.0	2.6	3.2	3.9	4.5	5.1	6.4	7.8
0.02	1.0	1.3	1.6	2.1	2.5	3.1	3.9	4.7	5.5	6.3	7.8	9.4
0.03	1.2	1.5	1.9	2.4	2.9	3.7	4.6	5.6	6.5	7.4	9.2	11.1
0.04	1.3	1.7	2.2	2.8	3.4	4.3	5.3	6.4	7.5	8.5	10.6	12.8
0.05	1.5	1.9	2.5	3.1	3.8	4.9	6.0	7.2	8.4	9.6	12.0	14.5
0.06	1.7	2.2	2.7	3.5	4.3	5.4	6.7	8.0	9.4	10.7	13.4	16.1
0.07	1.8	2.4	3.0	3 9	4.7	6.0	7.3	8.9	10.4	11.9	14.8	17.8

*The Boramé-Julien method of calculating horse-powers was described in the *Automobile Magazine* for October.—Editor.

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SPEED OF 20 KILOMETRES PER HOUR.

H. P. = French *cheval-vapeur*, 0.9863 H. P.

GRADES.	LOADS PULLED, WEIGHT OF VEHICLE INCLUDED.											
	300	400	500	650	800	1000	1250	1500	1750	2000	2500	3000
	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.
om.co.....	1.0	1.3	1.6	2.0	2.5	3.0	3.8	4.5	5.3	6.0	7.5	9.0
0.01.....	1.2	1.6	1.9	2.5	3.0	3.8	4.7	5.6	6.6	7.5	9.4	11.2
0.02.....	1.4	1.9	2.3	3.0	3.6	4.5	5.6	6.7	7.9	9.0	11.2	13.4
0.03.....	1.6	2.2	2.7	3.4	4.2	5.3	6 5	7.9	9.2	10.5	13.1	15.6
0.04.....	1.9	2.5	3.0	3.9	4.8	6.0	7.5	9.0	10.5	11.9	14.9	17.9
0.05.....	2.1	2.8	3.4	4.4	5.4	6.7	8.4	10.1	11.8	13.4	16.8	20.1
0.06.....	2.3	3.1	3.8	4.9	6.0	7.5	9.3	11.2	13.1	14.9	18.6	22.3
0.07.....	2.5	3.4	4.2	5.3	6.7	8.2	10.2	12.3	14.4	16.4	20.5	24.5

SPEED OF 25 KILOMETRES PER HOUR.

H. P.—French *cheval-vapeur*, 0.9863 H. P.

GRADES.	LOAD PULLED, WEIGHT OF VEHICLE INCLUDED.											
	300	400	500	650	800	1000	1250	1500	1750	2000	2500	3000
	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.
om.00.....	1.4	1.8	2.2	2.8	3.4	4.2	5.3	6.3	7.3	8.3	10.4	12.4
0.01.....	1.7	2.2	2.7	3.4	4.2	5.2	6.4	9.7	8.9	10.2	12.7	15.2
0.02.....	2.0	2.5	3.1	4.0	4.9	6.1	7.6	9.1	10.6	12.0	15.0	18.0
0.03.....	2.2	2.9	3.6	4.6	5.6	7.0	8.7	10.4	12.2	13.9	17.3	20.7
0.04.....	2.5	3.3	4.0	5.2	6.4	8.0	9.9	11.9	13.8	15.7	19.7	23.5
0.05.....	2.8	3.6	4.5	5.8	7.1	8.9	11.0	13.2	15.5	17.6	22.0	26.3
0.06.....	3.1	4.0	4.9	6.4	7.9	9.8	12.2	14.6	17.1	19.4	24.3	29.0
0.07.....	3.4	4.4	5.4	7.0	8.6	10.8	13.3	16.0	18.8	21.3	26.6	31.8

SPEED OF 30 KILOMETRES PER HOUR.

H. P. = French *cheval-vapeur*, 0.9863 H. P.

GRADES.	LOAD PULLED, WEIGHT OF VEHICLE INCLUDED.											
	300	400	500	650	800	1000	1250	1500	1750	2000	2500	3000
	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.
om.oo	1.9	2.4	3.0	3.7	4.6	5.7	7.0	8.3	9.7	11.0	13.7	16.4
0.01	2.2	2.8	3.5	4.5	5.5	6.8	8.4	10.0	11.6	13.2	16.5	19.7
0.02	2.6	3.3	4.1	5.2	6.3	7.9	9.8	11.6	13.5	15.5	19.3	23.0
0.03	2.9	3.7	4.6	5.9	7.2	9.0	11.1	13.3	15.5	17.7	22.1	26.4
0.04	3.2	4.1	5.2	6.7	8.1	10.1	12.5	15.0	17.4	19.9	24.8	29.7
0.05	3.5	4.6	5.7	7.4	9.0	11.2	13.9	16.6	19.4	22.1	27.6	33.0
0.06	3.9	5.0	6.3	8.1	9.9	12.3	15.3	18.3	21.3	24.3	30.4	36.4
0.07	4.2	5.5	6.8	8.9	10.7	13.4	16.7	20.0	23.2	26.6	33.2	39.7

SPEED OF 35 KILOMETRES PER HOUR.

H. P. = French *cheval-vapeur*, 0.9863 H. P.

GRADES.	LOAD PULLED, WEIGHT OF VEHICLE INCLUDED.											
	300	400	500	650	800	1000	1250	1500	1750	2000	2500	3000
	H. P.	H. P	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.
om.oo	2.5	3.2	3.8	4.9	5.9	7.2	9.0	10.7	12.4	14.1	17.5	20.8
0.01	2.9	3.7	4.5	5.7	7.0	8.5	10.6	12.6	14.6	16.7	20.7	24.7
0.02	3.3	4.2	5.1	6.5	8.0	9.8	12.2	14.5	16.9	19.2	23.9	28.6
0.03	3.6	4.7	5.8	7.4	9.1	11.1	13.8	16.5	19.2	21.8	27.1	32.4
0.04	4.0	5.2	6.4	8.2	10.1	12.4	15.4	18.4	21.4	24.4	30.3	36.3
0.05	4.4	5.7	7.0	9.1	11.1	13.7	17.0	20.4	23.7	27.0	33.6	40.2
0.06	4.8	6.2	7.7	9.9	12.1	15.0	18.6	22.3	25.9	29.6	36.8	44.0
0.07	5.2	6.7	8.3	10.7	13.2	16.3	20.2	24.2	28.2	32.1	40.0	47.9

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SPEED OF 40 KILOMETRES PER HOUR.

H. P. = French *cheval-vapeur*, 0.9863 H. P.

GRADES.	LOAD PULLED, WEIGHT OF VEHICLE INCLUDED.											
	300	400	500	650	800	1000	1250	1500	1750	2000	2500	3000
	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.
om.00	3.2	4.1	4.9	6.2	7.5	9.1	11.2	13.3	15.5	17.6	21.8	26.0
0.01	3.7	4.7	5.6	7.2	8.7	10.6	13.1	15.6	18.1	20.6	25.5	30.5
0.02	4.1	5.3	6.3	8.1	9.8	12.1	15.0	17.8	20.7	23.5	29.2	34.9
0 03	4.5	5.9	7.0	9.1	11.0	13.6	16.8	20.0	23.2	26.5	32.9	39.4
0.04	5.0	6.4	7.7	10.1	12.2	15.0	18.6	22.2	25.8	29.5	36.6	43.8
0.05	5.4	7.0	8.4	11.0	13.4	16.5	20.5	24.4	28.4	32.4	40.3	48.3
0.06	5.9	7.6	9.1	12.0	14.6	18.0	22.3	26.7	31.1	35.4	44.0	52.7
0.07	6.3	8.2	9.8	12.9	15.7	19.5	24.2	28.9	33.6	38.3	47.7	57.1

Formula: $Nch = \frac{f + e}{75}$

Nch = expression of the work in horse-powers; f = force in kilogramme-exerted tangentially to the driving-wheel; e = distance in meters covered in a second by the carriage.

TABLE OF FORCES.

Exerted tangentially to the driving-wheel of an automobile, calculations being based on the load (weight of vehicle included), the grade, and the speed.

SPEED OF 15 KILOMETERS PER HOUR.

GRADES.	LOAD PULLED, WEIGHT OF VEHICLE INCLUDED.											
	300	400	500	650	800	1000	1250	1500	1750	2000	2500	3000
	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.
om.00	11.5	15.0	19.0	24.0	29.0	36.0	45.0	54.0	63.5	72.0	90.0	109.0
0.01	14.5	19.0	24.0	30.5	37.0	46.0	57.5	69.0	81.0	92.0	115.0	139.0
0.02	17.5	23.0	29.0	37.0	45.0	56.0	70.0	84.0	98.5	112.0	140.0	169.0
0.03	20.5	27.0	34.0	43.5	53.0	66.0	82.5	99.0	116.0	132.0	165.0	199.0
0.04	23.5	31.0	39.0	50.0	61.0	76.0	95.0	114.0	133.5	152.0	190.0	229.0
0.05	26.5	35.0	44.0	56.5	69.0	86.0	107.5	129.0	151.0	172.0	215.0	259.0
0.06	29.5	39.0	49.0	63.0	77.0	96.0	120.0	144.0	168.5	192.0	240.0	289.0
0.07	32.5	43.0	54.0	69.5	85.0	106.0	132.5	159.0	186.0	212.0	265.0	319.0
	0.75	0.80	0.85	0.90	1.00	1.10	1.20	1.35	1.50	1.65	1.90	2.20

Approximate areas, in square metres, on which the resistance of the air acts.

SPEED OF 20 KILOMETRES PER HOUR.

GRADES.	LOAD PULLED, WEIGHT OF VEHICLE INCLUDED.											
	300	400	500	650	800	1000	1250	1500	1750	2000	2500	3000
	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.
0m.00	13.2	17.0	21.0	26.7	33.0	41.0	51.0	61.0	71.2	81.2	101.5	121.3
0.01	16.2	21.0	26.0	33.2	41.0	51.0	63.5	76.0	88.7	101.2	126.5	151.3
0.02	19.2	25.0	31.0	39.7	49.0	61.0	76.0	91.0	106.2	121.2	151.5	181.3
0.03	22.2	29.0	36.0	46.2	57.0	71.0	88.5	106.0	123.7	141.2	176.5	211.3
0.04	25.2	33.0	41.0	52.7	65.0	81.0	101.0	121.0	141.2	161.2	201.5	241.8
0.05	28.2	37.0	46.0	59.2	73.0	91.0	113.5	136.0	158.7	181.2	226.5	271.3
0.06	31.2	41.0	51.0	65.7	81.0	101.0	126.0	151.0	176.2	201.2	251.5	301.3
0.07	34.2	45.0	56.0	72.2	89.0	111.0	138.5	166.0	193.7	221.2	276.5	331.3
	0.75	0.80	0.85	0.90	1.00	1.10	1.20	1.35	1.50	1.65	1.90	2.20
	Approximate areas, in square metres, on which the resistance of the air acts.											

SPEED OF 25 KILOMETRES PER HOUR.

GRADES.	LOAD PULLED, WEIGHT OF VEHICLE INCLUDED.											
	300	400	500	650	800	1000	1250	1500	1750	2000	2500	3000
	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.
0m.00	15.0	19.2	23.6	30.0	37.0	45.7	57.0	68.0	79.0	90.0	112.2	134.2
0.01	18.0	23.2	28.6	36.5	45.0	55.7	69.5	83.0	96.5	110.0	137.2	164.2
0.02	21.0	27.2	33.6	43.0	53.0	65.7	82.0	98.0	114.0	130.0	162.2	194.2
0.03	24.0	31.2	38.6	49.5	61.0	75.5	94.5	113.0	131.5	150.0	187.2	224.2
0.04	27.0	35.2	43.6	56.0	69.0	85.5	107.0	128.0	149.0	170.0	212.2	254.2
0.05	30.0	39.2	48.6	62.5	77.0	95.5	119.5	143.0	166.5	190.0	237.2	284.2
0.06	33.0	43.2	53.6	69.0	85.0	105.5	132.0	158.0	184.0	210.0	262.2	314.2
0.07	36.0	47.2	58.6	75.5	93 0	115.5	144.5	173.0	201.5	230.0	287.2	344.2
	0.75	0.80	0.85	0.90	1.00	1.10	1.20	1.35	1.50	1.65	1.90	2.20
	Approximate areas, in square metres, on which the resistance of the air acts.											

The Truth About Motor Horse-Powers

SPEED OF 30 KILOMETRES PER HOUR.

GRADES.	LOAD PULLED, WEIGHT OF VEHICLE INCLUDED.											
	300	400	500	650	800	1000	1250	1500	1750	2000	2500	3000
	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.
om.oo	17.0	21.5	26.5	33.7	41.1	51.0	63.0	75.0	87.0	99.2	123.5	147.5
0.01	20.0	25.5	31.5	40.2	49.1	61.0	75.5	90.0	104.5	119.2	148.5	177.5
0.02	23.0	29.5	36.5	46.7	57.1	71.0	88.0	105.0	122.0	139.2	153.5	207.5
0.03	26.0	33.5	41.5	53.2	65.1	81.0	100.5	120.0	139.5	159.2	198.5	237.5
0.04	29.0	37.5	46.5	59.7	73.1	91.0	113.0	135.0	157.0	179.2	203.5	267.5
0.05	32.0	41.5	51.5	66.2	81.1	101 0	125.5	150.0	174.5	199.2	248.5	297.5
0.06	35.0	45.5	56.5	72.7	89.1	111.0	138.0	165.0	192.0	219.2	253.5	327.5
0.07	38.0	49.5	61.5	79.2	97.1	121.0	150.5	180.0	209.5	239.2	298.5	357.5
	0.75	0.80	0.85	0.90	1.00	1.10	1.20	1.35	1.50	1.65	1.90	2.20
	Approximate areas, in square metres, on which the resistance of the air acts.											

SPEED OF 35 KILOMETRES PER HOUR.

GRADES.	LOAD PULLED, WEIGHT OF VEHICLE INCLUDED.											
	300	400	500	650	800	1000	1250	1500	1750	2000	2500	3000
	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.
om.oo	19.4	24.5	29.7	37.7	46.0	56.1	69.5	82.7	96.0	109.0	135.3	161.5
0.01	22.4	28.5	34.7	44.2	54.0	66.1	82.0	97.7	113.5	129.0	160.3	191.5
0.02	25.4	32.5	39.7	50.7	62.0	76.1	94.5	112.7	131.0	149.0	185.3	221.5
0.03	28 4	36.5	44.7	57.2	70.0	86.1	107.0	127.7	148.5	169.0	210.3	251.5
0.04	31.4	40.5	49.7	63.7	78.0	96.1	119.5	142.7	166.0	189.0	235.3	281.5
0.05	34.4	44.5	54.7	70.2	86.0	106.1	132.0	157.7	183.5	209 0	260.3	311.5
0.06	37.4	48.5	59.7	76.7	94.0	116.1	144.5	172.7	201.0	229.0	285.3	341.5
0.07	40.4	52.5	64.7	83.2	102.0	126.1	157.0	187.7	218.5	249.0	310.3	371.5
	0.75	0.80	0.85	0.90	1.00	1.10	1.20	1.35	1.50	1.65	1.90	2.20
	Approximate areas, in square metres, on which the resistance of the air acts.											

SPEED OF 40 KILOMETRES PER HOUR.

GRADES.	LOADS PULLED, WEIGHT OF VEHICLE INCLUDED.											
	300	400	500	650	800	1000	1250	1500	1750	2000	2500	3000
	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.	K.
om.co.....	21.7	27.6	33.1	42.0	50.5	61.5	76.0	90.1	104.5	119.0	147.0	176.0
0.01.....	24.7	31.6	38.5	48.5	58.5	71.5	88.5	105.1	122.0	139.0	172.0	206.0
0.02.....	27.7	35.6	43.5	55.0	66.5	81.5	101.0	120.1	139.5	159.0	197.0	236.0
0.03.....	30.7	39.6	48.5	61.5	74.5	91.5	113.5	135.1	157.0	179.0	222.0	266.0
0.04.....	33.7	43.6	53.5	68.0	82.5	101.5	126.0	150.1	174.5	199.0	247.0	296.0
0.05.....	36.7	47.6	58.5	74.5	90.5	111.5	138.5	165.1	192.0	219.0	272.0	326.0
0.06.....	39.7	51.6	63.5	81.0	98.5	121.5	151.0	180.1	209.5	239.0	297.0	356.0
0.07.....	42.7	55.6	68.5	87.5	106.5	131.5	163.5	195.1	227.0	259.0	322.0	386.0
	0.75	0.80	0.83	0.90	1.00	1.10	1.20	1.35	1.50	1.65	1.90	2.20
	Approximate areas, in square metres, on which the resistance of the air acts.											

Formula, $F = P\ (0.025 + 0.0007\ v + p) + s\ v^2 + 0.0048$.

F = force tangential to the driving-wheel; P = weight in kilogrammes of the entire load; 0.025 = co-efficient of the resistance offered by an ordinary road to wheels having an average diameter of 0.80 metres; v = speed in kilometres; 0.0007 + v = term proportional to the speed and relative to the resistance due to jars occasioned by inequalities in the road; p = grade per metre; s = area of surface in sq. metres, upon which the resistance of the air acts; $s\ v^2 + 0.0048$ = expression of the resistance of the air.

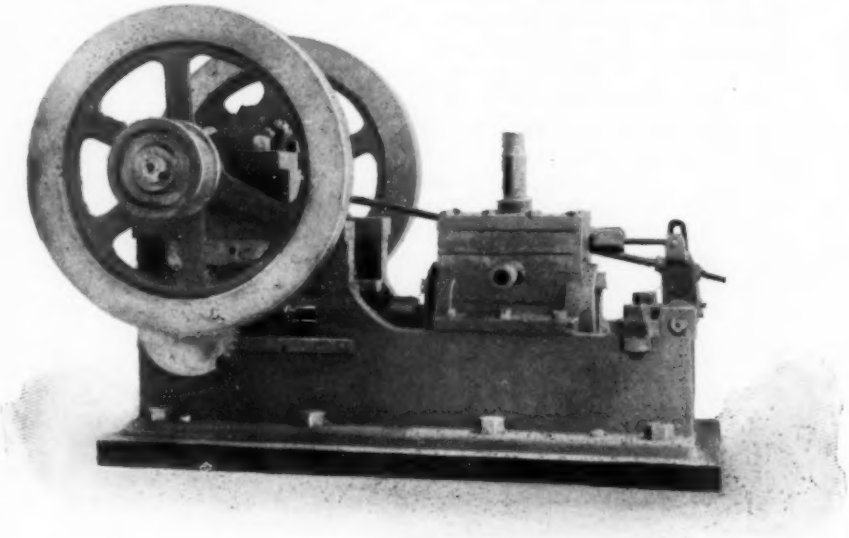
WHY THESE RACES?

The French and American motor races are practically trial trips for speed, strength, and reliability, and are giving the French and Americans their superiority. The recent races in France have been attended by scores of German and American engineers. The last two contests were, it is pleasing to note, witnessed by English engineers also. I noticed several of them examining the winning carriages, camera and note-book in hand, at Ostend the other day, and many were at Boulogne. The foreigner has borrowed so much from us that a little reciprocity is quite in order. No one wants to travel forty miles an hour, but everyone desires an absolutely reliable engine. These races, over all kinds of roads, have revealed the weak points in construction, and have proved the worth of new inventions.—*London Chronicle.*

An Improved Power-Transmitting Mechanism

By E. E. Schwarzkopf

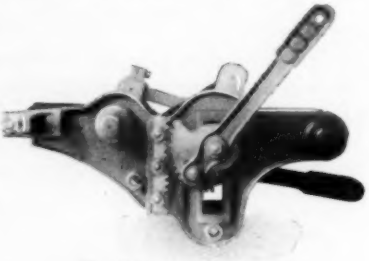
IN order to transmit the power imparted to the piston of an engine with a greater degree of efficiency than has been attainable by means of the directly-connected crank, inventors have devised many curiously-constructed gears which are designed to overcome the difficulties ordinarily encountered in power-



Stationary Engine with New Power-Transmitter

transmission. Among these devices the rolling, cogged cross-head mounted between a fixed rack and a moving rack driven by the piston-rod, has figured prominently. There has also been used, with more or less success, a toothed, fulcrum-wheel rolling on a stationary rack, with the piston-rod coupled to the wheel-journals and the crank connected with the wheel at a point less distant from the center of the latter than the length of the crank.

A mechanism in which both of these systems have been combined, has been invented by Mr. W. A. Pitt, of Stamford, Conn., and has been employed with noteworthy success in engines and foot-power appliances. The improvement consists essentially in mounting the crank-shaft with its axis parallel with the fulcrum-wheel, but in a different plane. Not only is the old problem in engine-building of overcoming the dead centers effectually solved, but an evenness of turning moment is obtained which adds much to the efficiency of the engine.



Food Power Appliance

The new power-transmitting mechanism, as indicated in Fig. 1, a side elevation representing the device applied to a double-cylinder engine, comprises essentially two similar cranks C and C^x set oppositely at the ends of a driving-shaft A. Coupled to the cranks are connecting-rods F and F^x pivoted at their lower ends to lever-arms G and G^x. These lever-arms are driven by gear-wheels H and H^x, meshing respectively with

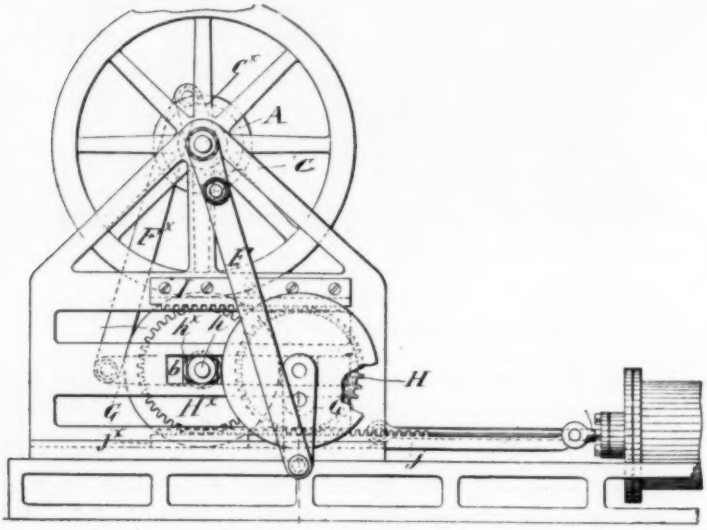


Fig. 1 Side Elevation

fixed racks I and I^x and with sliding racks j and j^x, connected with the piston-rods.

The connecting-rods are five times as long as the cranks C and C^x. The lever-arms G and G^x are twice as long as the cranks and therefore make one-quarter of a revolution for two-thirds of a revolution of the cranks. The size of the fulcrum or gear wheels H and H^x is such that in rolling on the fixed racks through a quarter of a revolution, the centers of the wheels will travel in the slots b a distance equal to the length of the lever-arms G and G^x. The stroke of each piston will be equal to the distance traveled by the center of the corresponding gear-wheel, plus one-fourth the circumference of the wheel measured on the pitch-circle.

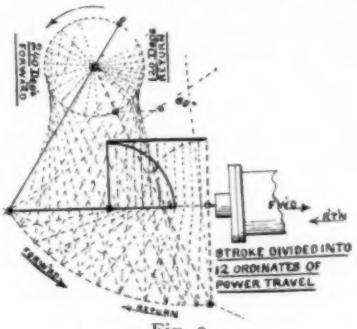


Fig. 2

As the piston-rods reciprocate the sliding racks, the wheels H and H^x roll along the upper fixed racks and swing the lever-arms G and G^x through one-quarter of a revolution. When one of the cranks, C or C^x, is on the upper dead center of its path, the corresponding lever-arm will be in a horizontal position, and its extremity will be two crank-lengths beyond the center of crank motion in a plane parallel to a horizontal line drawn through that center. The piston-rod will then have reached the end of its outstroke. As the piston-rod returns, it moves with a constantly-accelerated movement, drawing with it the sliding rack and causing the corresponding gear-wheel to roll upon its fixed rack, the lever-arm to swing through 90° to a vertical position, and simultaneously to be drawn through a distance equal to the diameter of the crank-pin-path circle, in a plane parallel to a horizontal plane passing through the center of the crank-motion. Hence the extremity of the lever-arm describes an epicycloid (Fig. 2) measuring an arc equal to one-sixth of a circle, the radius of which circle is equal to the chord connecting the extremities of the epicycloid.

For one piston-stroke, each crank will be rotated 240°. And since on the return stroke of the piston the crank has to move only through 120°, the piston returns double the velocity of the forward stroke. In a two-cylinder engine, the driving-shaft is alternately acted upon; while one piston controls or sustains the load, the other imparts motion. In a single-cylinder engine

the crank also rotates 240° for every forward piston-stroke, with the dead centers 240° apart on the one side and 120° on the other.

Let us compare the operation of an engine fitted with this new power-transmitting mechanism with that of an ordinary engine having the usual directly-connected piston and crank. In the ordinary engine the power is first exerted on a minimum length of crank leverage, reaches a maximum at approximately the middle of the stroke, and finally falls to a minimum at the end of the stroke. In the new contrivance a minimum power is exerted at the beginning of the stroke, and the crank is pulled upon with a maximum momentum; at the end of the stroke a maximum power is exerted, the momentum being a minimum.

Other means than a sliding rack may be employed to roll and reciprocate the gear or fulcrum wheels along the fixed racks. In the engine illustrated a segment-gear is used in place of the full gear-wheel and connected with the piston-rod by means of an ordinary sliding cross-head. The principle of operation is obviously the same as that first described.

When a two-cylinder engine is used, the cranks are never on dead centers at the same time; and when one crank is on the dead center there will always be sufficient leverage on the other to pull it off. When only a single cylinder is employed, the motor is made to act through considerably more than one-half the crank-travel, so that the flywheel is required to carry the shaft through less than half a revolution. Besides overcoming the dead centers, the mechanism possesses the merit of applying its power tangentially to the crank, thereby obtaining the greatest possible efficiency for a given expenditure of power.

A BOON FOR PHYSICIANS

Motor-cars, according to the London *Daily Mail,* are becoming daily more popular with the medical profession. In fine weather a motor-tricycle serves the purpose of a country medical man excellently, and enables him to cover his rounds with great saving of time. For wet weather a hooded phaeton, driven by a motor, with plenty of power, enables a doctor to see his patients without the anxiety attendant on leaving valuable horses standing in the rain.

The motor is always ready to start at a moment's notice to attend to a night call.

The Ravel "Intensif" Motor

By Gustave Chauveau

IN his new motor, M. Ravel, whose name is well known to specialists, has endeavored to obtain a higher power within a definite bulk and weight; and hence the name "Intensif" applied to his last production.

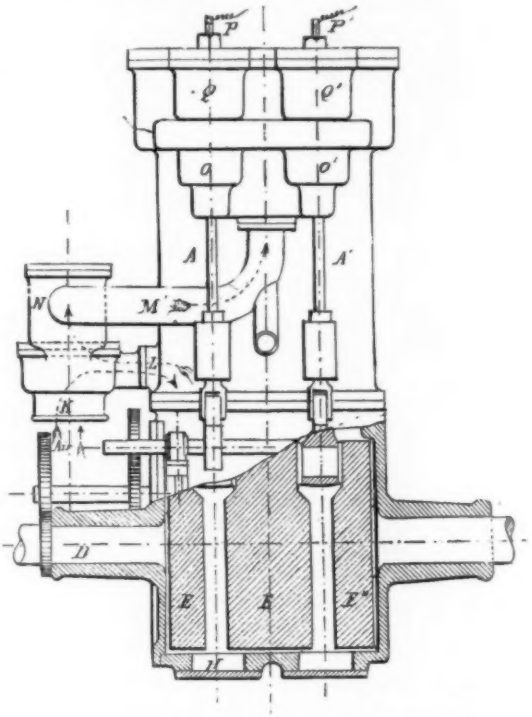


Fig. 1. Front View

Before proceeding to a description of this motor, we shall enter into a few considerations that we regard as indispensable.

The gasoline motors of what is called the four-cycle type are, as well known, almost exclusively adopted at present, especially

for use upon automobiles. Such motors comprise, in principle, a cylinder in which moves a piston that actuates the driving-shaft, and above the upper dead-point of which is situated a chamber that contains the distributing parts and the igniting device. The operation of such a motor is as follows: The piston being supposed to be at the end of its up-stroke, at the time of the admission-period, the chamber above is full of the products of the preceding combustion. When the flywheel causes the piston to

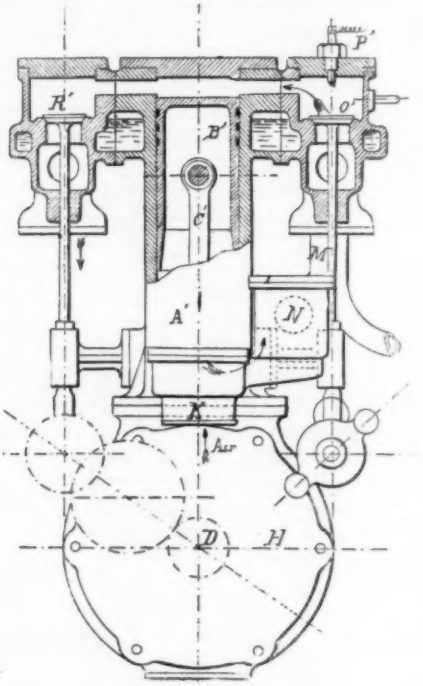


Fig. 2. Side View

descend, a partial vacuum is formed in the rear of the latter, the admission-valve opens mechanically (or automatically, rather) under the action of the vacuum, and the explosive mixture enters the cylinder and drives before it the products of combustion, which follow the piston. At the end of the down-stroke, the piston again rising under the impulsion of the flywheel, the admission-valve closes, and the explosive mixture admitted is forced into the chamber above.

As the volume of the latter is less than that of the space in the cylinder unoccupied by the piston, there results a compression of the mixture varying in degree with the ratio between the two volumes just mentioned. In automobile motors, the compression reaches, practically, from about 35 to 45 pounds to the square inch.

When the mixture is ignited in an appropriate manner in the vicinity of the upper dead-point, there ensues an explosion which develops a pressure of from 175 to 220 pounds to the square inch. The piston, upon being driven downward through such pressure,

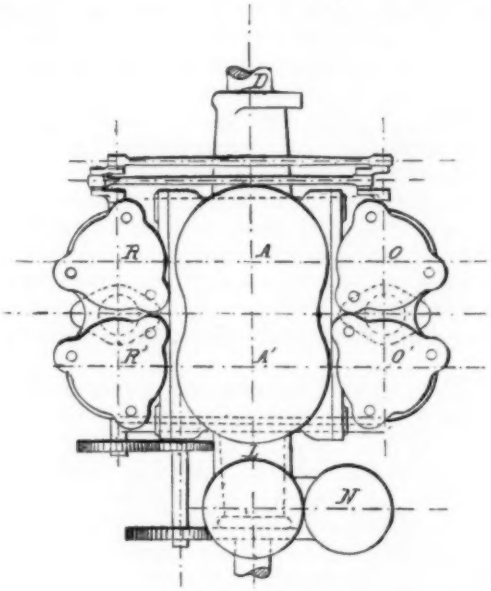


Fig. 3. Plan

gives the flywheel a sufficiently strong impulsion to permit it to effect the other strokes, while the products of combustion expand; that is to say, lose their temperature and pressure. Just before the end of the down-stroke, a communication with the exterior being established, while the pressure is still in the vicinity of 45 pounds to the square inch, the exhaust begins, and the piston, in rising, forces to the exterior, as far as to the end of its up-stroke, the products of the combustion that has just taken place. A new admission then occurs, and so on.

We thus see that if we have a free cylinder space of a definite volume, and force the mixture into a chamber of another definite volume, we shall obtain a compression of, say, from 35 to 45 pounds that will produce an explosive pressure of from 175 to 220 pounds, the expansion bringing the pressure to the neighborhood of 45 pounds and the exhaust to that of the atmosphere. The mean pressure during the motive stroke will be practically from 65 to 75 pounds per square inch of piston surface, corresponding to a definite power for a definite velocity. Upon the whole, under definite conditions of velocity and piston surface, of richness of the explosive mixture, and of ratio between the volume of the cylinder space and that of the compression chamber, we shall have for a given cylinder charge expanded in one cylinder a definite mean pressure corresponding to a likewise definite power.

If, then, through some arrangement or other, we succeed in having two cylinder charges instead of one, of the same explosive mixture, and compress both in one double chamber, we shall finally have a double mass of an identical explosive mixture, at the same degree of compression, giving the same explosive power; but if, instead of expanding this double mass in two cylinders, we expand it in but one, the products of combustion will begin to escape at a pressure much higher than the preceding, and the mean pressure will be increased in definite proportions, and be, practically, nearly doubled.

We shall thus succeed in obtaining a power that is sensibly double, within a volume and weight that remain sensibly the same.

This is what M. Ravel has succeeded in doing in his "Intensif" motor (Figs. 1, 2 and 3), which consists of two vertical cylinders, *A A'*, placed side by side, and the pistons, *B B'*, of which move at the same time. These pistons, through the connecting-rods *C C'*, actuate the driving-shaft *D*, which carries crank-plates, *E E' E''*, that act as flywheels. The whole is placed in a casing, *H*, the free space in which is reduced as much as possible by the bulk of the pieces which it contains.

This casing is capable of communicating with the exterior through a butterfly-valve placed at *K*, and a conduit, *L;* and, with the compression chamber of the two cylinders, through the same conduit, *L*, and another conduit, *M*, between which is interposed a carbureter, *N*.

The conduit *M* debouches beneath the admission-valves, *O O'*, above which are located the igniters, *P P'*. The exhaust-valves are on the other side, at *R R'*.

The Ravel "Intensif" Motor

A circulation of water assures the cooling of the valves, and a governor keeps the velocity within definite limits. The admission and exhaust-valves, as well as the igniters and the governor, are controlled by a series of gearings, shafts, cams and appropriate contacts, of which the arrangement may be easily imagined. The intermediate shafts, of course, revolve at half the velocity of the driving-shaft.

Let us now see how the motor operates: One of the pistons, say B', for example, being at the end of its up-stroke during the working period, the other one, B, will be likewise at the upper dead-point; but, at the time of the admission-period, the piston B', forced downward, will carry B along with it, and both will drive before them the air that fills the lower part of the two cylinders. At this moment, the admission-valve O being open, this air, passing through L and M, will enter the cylinder A, after becoming carbureted by traversing N in part. At the lower dead-point, the exhaust will be continued in A', while the admission will cease in A. The pistons, then returning in an opposite direction, will form a vacuum; and pure air, entering through the valve K, will flow into the casing H and fill the lower part of the cylinders, while the exhaust that follows an admission will finish in A', and the compression that follows an explosion will take place in A.

We thus see the four cycles completed in each of the cylinders alternately, the bottom charging the top.

But what should be well remarked is that the two cylinders that suck the air admit at the same time two charges of explosive mixture, which are forced into a single compression chamber of double the volume of an ordinary one. The principle enunciated above is therefore well worked out.

Since the governor closes the admission-valve when the velocity becomes too great, there is less of an admission, and, consequently, a feebler compression, explosion and mean pressure, which re-establish the equilibrium.

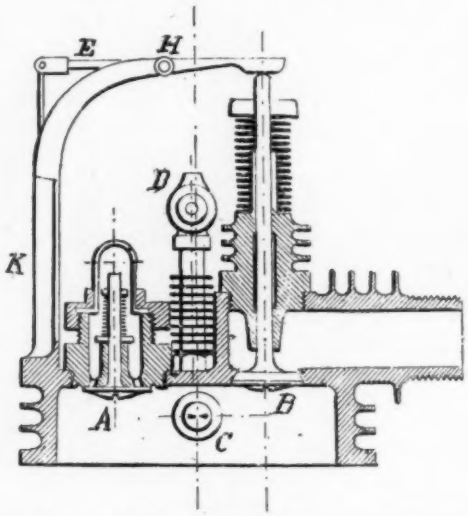
A reduction of the weight and bulk of automobile motors is so important a matter and the means employed by M. Ravel to reach the result are so ingenious that we have not dwelt at any too great a length upon the "Intensif." There is, nevertheless, reason for remarking that the feeble expansion of this motor will be attended with a poor rendering, and consequently a high consumption, and that the exhaust mechanism will be submitted to very high temperatures.

Let us wait, then, until practice, our great mistress, shall furnish us with a decisive opinion.

The Buchet Head for Working-Chambers

THE Buchet cylinder-head which is represented in the annexed engraving is applicable to all motors of the De Dion and Aster type. The increase in power gained by means of the attachment is said to be as large as thirty per cent.

The admission-valve, the exhaust-valve, the igniter, and the relief-valve are of the usual kind; but instead of placing the first three in a recess formed in the wall of the cylinder and communicating with the latter by means of a passage, the inventor has



mounted them in a chamber constituting a prolongation of the cylinder, with the same diameter. The valves are directly placed on the cylinder head, with the relief-valve at *D*. The stem of the valve *B* is upwardly prolonged, so that it can engage the free end of a lever *E* fulcrumed at *H* and supported by a casting *K* on the cylinder.

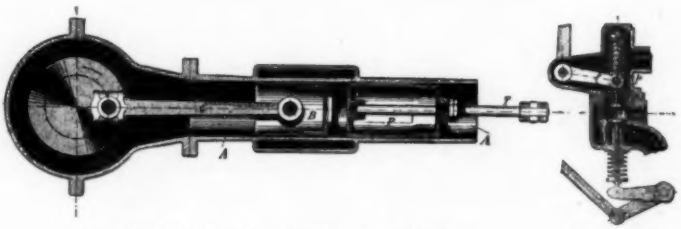
At first blush it would seem that the arrangement of parts is open to criticism, because it might be difficult to obtain a pure mixture of air and gas about the igniter. But the tests to which the invention has been subjected contradict the supposition.

An Improved Explosion-Engine

By Baudry de Saunier

A FRENCH engineer, M. Marmonier, of Lyon, has invented a hydrocarbon-motor which presents many advantages over the explosion-engines at present in use on automobiles. Chief among these advantages may be mentioned an expenditure of power proportional to the speed of the vehicle and a simplicity of construction which is so often conspicuously lacking in automobile-engines.

The motor is composed of two cylinders *A A*, mounted parallel to each other and open at both ends. Each cylinder incloses, besides, a piston *B*, connected with the motor-shaft by a rod *b* and a crank *m*, a counter-piston *P* connected with the correspond-



Longitudinal Section through Cylinders

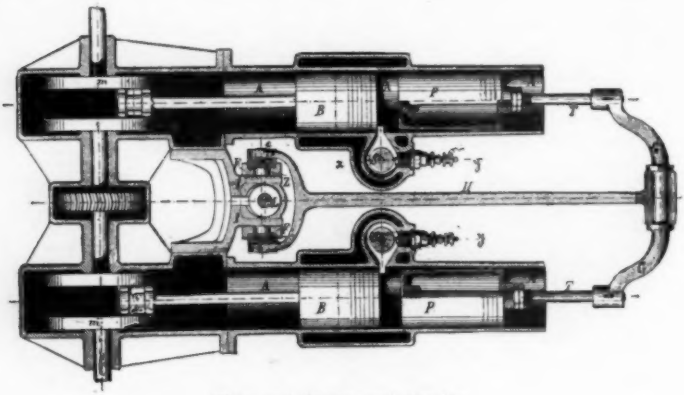
Section on line X Y

ing piston of the other cylinder by means of a rod *T* and a cross-head *G*. The crank-shaft carries a pinion meshing with a gear-wheel, the parts being so proportioned that the gear-wheel rotates with half the speed of the pinion. This gear-wheel, lettered *D* in Fig. 2, is provided on each of its lateral faces with a cam *d* engaging a friction-roller *E* connected by means of a rod with the link *F*, oscillating on a pivot *Z*. The shaft *L* of the governing-wheel is formed at one end with a worm *M*, controlling a slide adapted to move vertically in lateral flanges of the slide. This movable slide is connected with a rod *H*, pivoted at its outer extremity to the cross-head *G*.

Let us suppose that the engine is about to begin the first cycle. The piston, as it moves, opens the admission-valve; and the cam *d*, through the medium of the roller *E*, shifts the rod *K*

and causes the link F to swing from right to left. If the slide be in such a position that the rod H is in line with the axis of the cylinder, the counter-piston, P, will remain stationary, in which case the quantity of mixture admitted will be equal to the volume displaced by the piston. But if the slide occupy a lower position on the link, the rod H will force the counter-piston into the cylinder simultaneously with the intake stroke of the piston B; the quantity of gas admitted is then diminished. The lower the position of the slide on the link, the smaller will be the quantity of gas admitted; and when the slide is in its lowermost position the gas will be entirely cut off.

If the slide move above the axis of the cylinder, the link being swung in the opposite direction, the counter-piston will move



Plan and Horizontal Section

away from the piston B as the slide moves up, so that the counter-piston will suck in an additional quantity of fresh air.

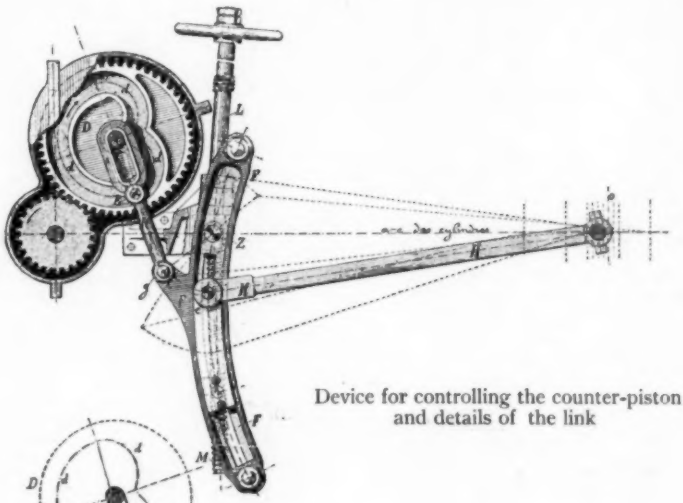
The second cycle—that of compression—now begins. The rollers E continue to turn on the cam d. The link swings from left to right; and the counter-piston returns to its initial position.

During the third and fourth cycles, the rollers turn on the concentric part of the cam d; and the link F, and, hence, the counter-piston P remain stationary. The stroke made by the piston B during this period is a working-stroke, followed by the expulsion of the burnt gases.

Only during the first two cycles is the link oscillated and the counter-piston displaced. During the two remaining cycles both link and counter-piston are stationary; and the slide, and, hence,

the counter-piston, remain in the positions assumed at the end of the first two cycles.

If the distance between the piston and counter-piston be one-half less than the normal, it follows that, (1) the quantity of burnt gases left in the cylinder at the end of the exhaust-stroke is also one-half less, that (2) the quantity of gas admitted is one-half less, and that (3) the compression will remain the same,



Device for controlling the counter-piston and details of the link

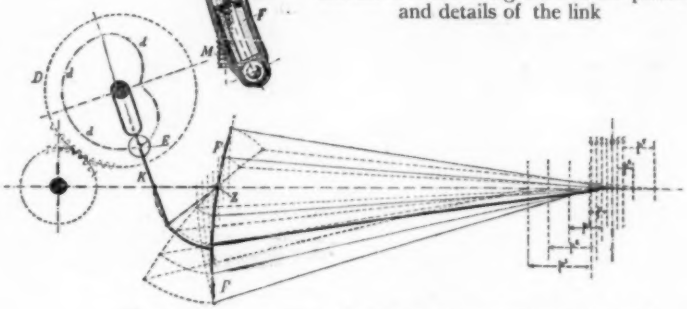


Diagram of the operation of the link

since there will be a volume of gas one-half less, within a space one-half less than the normal. The proportions of the constituents of the explosive mixture remain the same in all cases.

Conversely, when the slide passes above the pivot *Z* and the counter-piston moves away from the piston, the quantity of gas admitted will be greater, and the compression will be effected within a larger space.

When the slide is in its lowermost position, at which time there is no admission of gas, the counter-piston *P* approaches the piston *B* and follows it during its inoperative, intake stroke.

From the foregoing explanation it follows that the link in this engine of Marmonier's is similar to that of a steam-engine, and that it is the principal distributing device.

It has been stated that as the slide nears the end of its travel, the admission-valve is gradually closed. Hence, it follows that the pressure of the gases at the time of their cut-off might be less than that of the atmosphere. In this case the greater pressure of the atmosphere would cause the intake valve to open and admit a new supply of explosive mixture to the cylinder. The method of overcoming the difficulty is shown in the detail section forming part of Fig. 1. During each expansion of the gases in the cylinder, the spring of the intake valve is mechanically subjected to a greater tension than that of the escape-valve. Hence it follows, owing to the greater resistance offered by the intake-valve spring, that the escape-valve will be opened; and only pure air will be admitted to the cylinder.

The valves are thus operated by means of the cam previously mentioned, which cam, during the third cycle, besides controlling the escape-valve, also actuates the lever *l*, whereby the collar *p* is caused to tighten the spring.

AUTOMOBILE STREET SWEEPER

An automobile street sweeper, the invention of MM. Thomas and Lerocher, has recently been approved by the head of the street cleaning service of Paris, and will doubtless be in general use before the end of the present summer. The propelling machinery of the new automobile is placed in front, while underneath and behind are a tank and the sprinkling devices; for the wagon sprinkles the streets as well as sweeps them. The brushes come in the rear, and can be raised clear of the street while it is being sprinkled. The design is to run the car over the street to be cleaned, first sprinkling it, and then passing over it again to sweep the dust into small piles. It is the intention of the Paris authorities to also have electric wagons to remove the dust after it has been gathered into the heaps.

The Old and New Bollée Voiturettes

ALTHOUGH Léon Bollée's tricycle-voiturette has met with much favor in France by reason of its strong construction, speed, and simplicity, it cannot be denied that the vehicle is open to criticism. The tandem position of the passengers, the lack of comfort, the low construction and consequent exposure to dust and mud, and the frequent slipping of the single rear wheel offset the merits of the vehicle.

With the purpose of overcoming these defects the Société Anonyme des Voiturettes Automobiles, by whom Bollée's *voitu-*

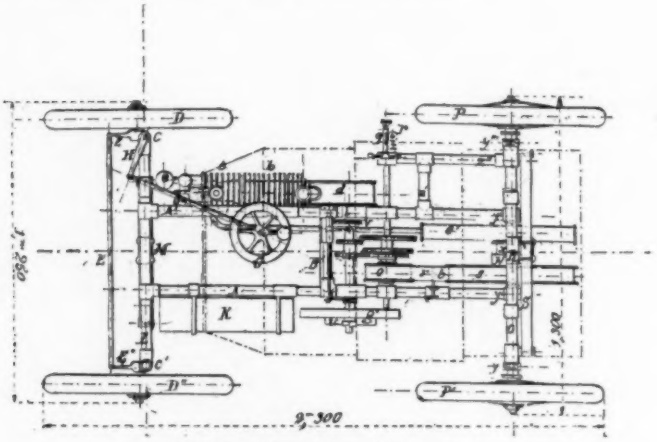
Bollée's Four Wheeler

rette patents are controlled, have designed a new, four-wheeled model, in which the seats are placed side by side and the frame sufficiently raised to overcome the objections to which we have referred. The simplicity which characterized the construction of the old model has been preserved; a single lever starts, changes the speed, and brakes the carriage.

Of our illustrations, Fig. 1 is a perspective view of the new *voiturette,* reproduced from a photograph. Figs. 2 and 3 are two

plan views in which the operating mechanism of a three and four wheeled *voiturette* are diagramatically compared, the dotted lines representing the carriage-bodies.

Those familiar with the tricycle-voiturette will recall that its frame consists of drawn-steel tubes, the two longitudinal members of which, *A A*, are connected by three lateral braces *B, B', B''*, the last of which, *B''*, is provided at its ends with two bearings *C C'* and an arm *D*. Two pivots are mounted to turn in the bearings *C C'*; and by these pivots the shafts or axles of the front, steering wheels *D' D''* are carried, which wheels are in turn connected by the divided axle *E E' E''* and controlled by the wheel *G* through the medium of a pinion, a rack *G'*, and a lever *H*. The driving-wheel *I* can be shifted forward or backward.



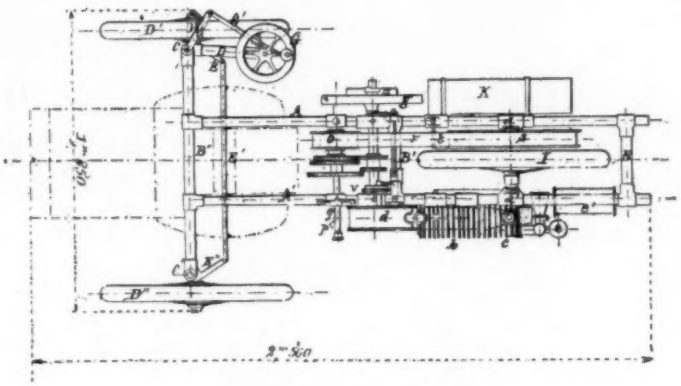
Bottom Plan of Four Wheeler

The motor consists of a flange-cooled cylinder *b*, a piston, and a head *c* inclosing the explosion-chamber, the gas-distributing and igniting devices. The connecting-rod is inclosed in a casing *d*; the carbureter is mounted at *e*; and the exhaust-muffle at *e'*.

The motor-shaft carries a fly-wheel *g* and three gear-wheels, and is journaled in bearings on the longitudinal members *A A'*. Parallel with the motor-shaft is an intermediate shaft likewise journaled in the members *A A'* and movable laterally. On the intermediate shaft are mounted three gear-wheels which can be thrown into engagement with the pulley *o*. By shifting the parts laterally in this manner, the several changes of speed are obtained, a gear-wheel on the intermediate shaft being made to engage the

corresponding gear-wheel on the motor-shaft. The shifting is effected by a lever connected with the intermediate shaft by means of the pinion *p* and the rack *q*.

The lever is also capable of being swung around the shaft in order to move the rear driving-wheel *I* backward or forward and thereby to tighten or loosen the belt *r*, running over the pulleys *o* and *s*. In this manner the driving-wheel is gradually thrown into and out of gear with the motive parts. The same operation of throwing the driving-wheel out of gear causes the pulley *s* to be forced into contact with a fixed brake-shoe *t*, whereby the vehicle is stopped. It is evident that only a single lever is necessary for the various operations of starting the carriage, changing the speed, throwing the driving-wheel out of gear with the inter-



Bottom Plan of Two Wheeler

mediate shaft, and forcing the pulley *s* into frictional contact with the brake-shoe *t*.

The motor is controlled by a ball-governor connected with the exhaust-valve and inclosed in a casing *u* secured to the fly-wheel *g*. The exhaust-valve is operated by a cam on the gear-wheel *v*. The hydrocarbon to be vaporized is contained in a reservoir *K*. The oil supply for the burner is located behind the rear seat.

The construction of the new quadricycle is essentially the same as that described. The frame has been turned about end for end, as a comparison of the two plan views will prove. The divided axle connecting the steering-wheels has been placed with-

out the frame instead of within; and the steering-wheels have been further connected by an axle L provided with a spring supporting the front portion M of the frame. Like the tricycle-voiturette the new carriage is steered by a wheel G, a rack G', and a lever H; but the rack and lever have been so connected with a rod that they can follow the movements of the front axle. The two rear driving-wheels $P\,P'$ are joined by an axle O, carrying at its middle a differential gear N, which here takes the place of the rear tricycle axle. The differential gear carries the driving-pulley and a gear for a Lemoine brake, x. As in the three-wheeled carriage the rear axle and its wheels can be shifted back and forth. A single lever is again employed for starting the vehicle, changing the speed, and braking, for which purpose the rear axle is supported by four bearings, at the points y, y', y'', y'''.

In order to hold the bearings in position a cross-piece R is employed which extends above the driving-pulley. Upon this part the carriage body is supported by means of a spring S.

The intermediate shaft has been lengthened to bring the operating-lever further inward; and the braces $z\,z'\,z''$ have been arranged accordingly. The carriage is steered with the left hand; and the lever is operated with the right hand, to both of which departures from the usual method, the driver becomes readily accustomed.

At the front of the carriage the oil supply for the burner, the lubricator, and the baggage-carrier are located.

The principal dimensions of the old and new vehicles are given in the following table:

	Tricycle.	Quadricycle.
Total length	8.40 ft.	7.54 ft.
Total width	4.10 "	4.26 "
Total height	3.44 "	4.59 "
Approximate weight (empty)	440 lbs.	660 lbs.
Speed in miles per hour	6, 12, 18	6, 12, 18

FREDERICK GOUGY.

THE KILOMETRE RECORD

M. Jenatzy, who at present holds the Automobile Kilometre Record (about 65 miles an hour), has heard that machines are being prepared to wrest this record from him. He states that if his record is lowered he will build an electric car to cover the kilometre at the rate of 125 miles an hour. These machines are playthings and fulfill no useful purpose.

The Locomobile

OF the three sources of energy (steam, gasoline, and electricity) which are generally used in mechanical traction, steam is preferred by many a *chauffeur* by reason of certain indisputable advantages which it possesses over its rivals. It is true that its employment entails the instalment of a boiler, and a rather complex engine. But the many improvements which, of late, have been made in the construction of steam-carriages have so thoroughly removed these obstacles that steam-driven vehicles are among the most popular at present in use. It can hardly be denied that the interests of steam traction have been very largely benefited by the introduction, both here and abroad, of an American steam-carriage which has become widely known under the name, "Locomobile."

The underlying principles which govern the construction of the Locomobile are not essentially different from those of other steam-carriages; but the vehicle has been so ingeniously designed,

that a description of the arrangement and construction of its driving mechanism will surely prove of interest to our readers.

Steam is generated in a small, tubular boiler and is conducted to a vertical, double-cylinder motor to drive two pistons, the reciprocating motion of which is converted into rotary motion by means of the usual connecting-rods and cranks. This rotary motion is imparted to the driving wheels through the medium of two sprockets and a chain connected with the differential. The entire carriage weighs about 425 pounds empty and 600 pounds loaded.

The Carriage Frame—Our illustrations show a light carriage-body supported on four wheels by a transverse spring in front and two longitudinal springs in the rear. The frame is composed of strong steel tubes 1¼ in. in diameter. The wheels are 28 in., small in size, are made entirely of metal, are provided with ball-bearings, and fitted with pneumatic tires.

The steering mechanism is the simplest imaginable and is composed of a handle bar or wheel controlling a central connecting rod which, by means of two links, operate the front wheels of the carriage.

In Fig. 4, representing a plan view of the "Locomobile," *D* is the steering bar or lever and *T* the oil supply tank for the burner

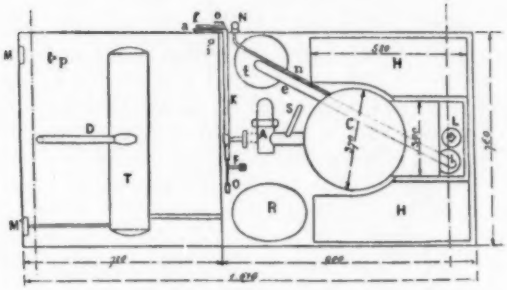


Fig. 4.

beneath the boiler, the tank being placed at the front of vehicle under the feet of the occupants. The boiler *C*, mounted in the rear, is flanked by the water-reservoir *HH*. The steam-admission valve is represented by *A*, the safety-valve pipe by *S*, and the exhaust outlet by *e*. The water reservoir is filled by removing the plug *L* and by inserting a hose. Two gauges *M M*[1] are provided, one of which indicates the pressure within the boiler and the other the air-pressure, whereby the oil is forced from the tank *T* to the burner, the pressure being maintained at the desired point by means of a hand-pump.

At the side of the driver's seat are three small levers, *a*, *f*, and *o*. The first lever (*a*) controls the steam-admission valve *A* and likewise serves as a means for regulating the speed, since there is no speed-changing gear as in petroleum carriages; the speed is regulated by limiting the quantity of steam admitted to the cylinders. The second lever *f* enables the driver to reverse the engine and drive the carriage backwards, and is connected with the steam-distributing devices *F* of the cylinders. The third lever *o* is connected with the feed-cock *O;* by its means the water is either pumped to the boiler or returned to the reservoir *H*.

The Boiler—The boiler is of the tubular type and is remarkable for its very rapid generation of steam. From a technical standpoint it is probably the most interesting part of the entire carriage. It is composed of a cylindrical, sheet copper body, reinforced by two windings of steel wire. At each end of this cylinder is a steel plate pierced with holes which receive 300 copper tubes (a^1, a^2, a^3, etc.), providing flues for the hot gases arising from the burners beneath the boiler.

The body of the burner, like that of the boiler, is cylindrical and is made of sheet metal, and mounted on square supports. A second, interior cylindrical casing receives the hydrocarbon,

already vaporized by its passage through a feed-tube, extending through the boiler and connecting with the burners. The second cylindrical casing contains 114 short copper tubes (c^1, c^2, c^3, etc., fig. 5), forming as many air-flues about which are located 20 capillary orifices through which the flames of the burning oil escape to heat the 300 vertical tubes of the boiler.

It will be understood that the oil flowing from the tank *T* is heated and vaporized as it passes vertically through the boiler, then escapes through the capillary orifices and ignites as it comes into contact with the air flowing through the small air-flues. But when the boiler is first started, some auxiliary means are evidently necessary to volatilize the oil. The means consist of an auxiliary heating tube, which connects the burner with the oil-feed tube.

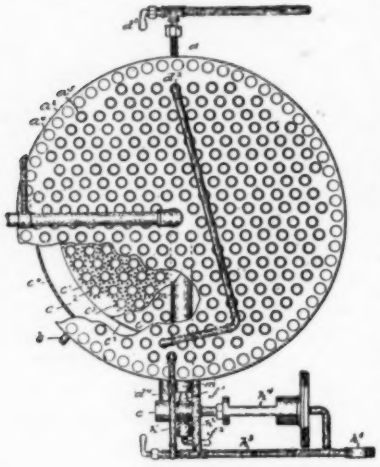


Fig. 5.

The steam is conducted through a pipe in the upper part of the boiler, to the admission-valve and thence to the cylinders. The products of combustion escape in the rear of the carriage.

In order to control the oil-feed of the burners, an ingenious, automatically-operating apparatus is provided, which is represented in Fig. 6. This oil-feed regulator is essentially composed of a metallic diaphragm held between the two members *E*. The right side of the diaphragm is subjected to the boiler-pressure; and the left side is connected with a needle-valve controlling the flow of oil, the stem of the valve being encased in the body *D* of the regulator. The oil flows through the tube *A* to the burner *B*, first passing through the opening commanded by the valve. The auxiliary heating-tube referred to above is mounted at *C*. The tube *F* connects the diaphragm with the boiler *A* so that the steam-pressure can act upon the diaphragm. When the pressure becomes excessive the needle-valve partially closes the feed opening and reduces the quantity of oil supplied to the burner. When the maximum pressure is reached the opening is almost closed.

The Engine—The motor (Figs. 7 and 8) consists of two

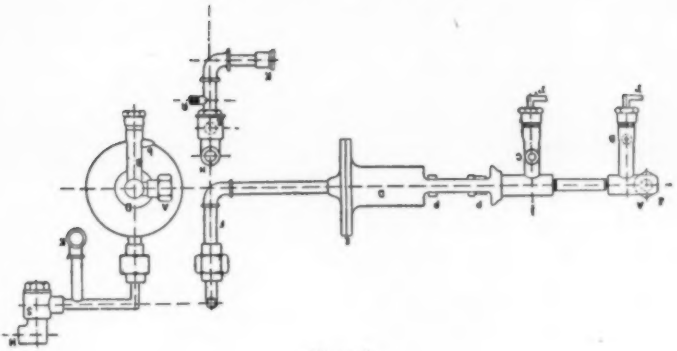


Fig. 6.

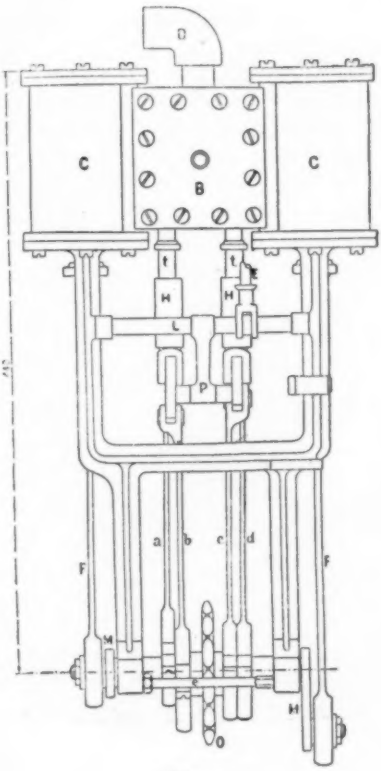


Fig. 7.

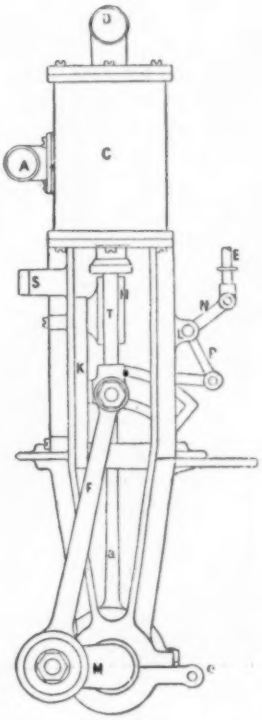


Fig. 8.

vertical cylinders *C C* and constitutes essentially a miniature marine engine. Steam is conducted to the steam chest *B* and to the cylinders by the pipe *D*. The slide-valve stems are represented by *t t;* their guides by *H H*. Two slides are provided, operated by the levers *E, N, P,* which actuate the rods of the eccentrics *a, b, c,* and *d*. *F F* are the connecting-rods; *M M* the cranks; *o* a 12-tooth sprocket-wheel, chain-connected with a 24-tooth sprocket in the differential gear, mounted in the center of the axle of the rear driving-wheels. The steam is exhausted through the pipe *A*, with no noise whatever. The cranks and eccentrics have ball-bearings, thereby reducing friction and noise. Two brakes are provided, one connected with the differential and operated by a pedal, the other connected with friction bands on the driving-wheels and operated by a lever.

The boiler is subjected to a water pressure of 600 pounds to the square inch, and the construction is such that it is impossible to explode it.

The Locomobile is noteworthy for its easy running and total lack of noise.

This was the verdict of Fire Chief Croker of New York, who used this machine for several months while responding to fire alarms. At his suggestion Fire Commissioner Scannell likewise took with him a Locomobile when he sailed to Cuba to reorganize the Fire Department of Havana.

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Editorial Comment

IF the new year witnesses the same degree of progress in automobile affairs that has distinguished 1899, then the visible effects of the work that has been done will be something prodigious. There is, indeed, no occasion for the use of the qualifying "if." It is safe to make the positive assertion that such will be the case, and that, moreover, the progress made will be even greater than that represented in the phenomenal record of 1899. The past year has been emphatically one of organization. The extent to which tremendous undertakings have been set on foot has constituted one of the most dramatic passages in the history of modern industrial development. Previous to the year 1899 everything done was in the way of preliminary work: experimentation, preparing the ground, and laying the foundations; all proceeding so quietly as to attract little general attention. Only a few far-sighted observers realized that one of the greatest of the advances in this century of achievements was at hand—an advance that men had been looking for ever since the invention of the steam engine made mechanical traction a potentiality.

When capital suddenly came to a realization of the magnificent scope of this new opportunity, it found the preliminary work

thereby carried to a stage so advanced that little remained to be done in order to proceed with production on the enormous scale required by the demand awaiting to be supplied. So it was natural that, when the work of organization was taken in hand on a scale so tremendous early in the past year, the same makers should have been called to a leadership in the work which will make the bicycle industry, enormous as it has grown to be, insignificant in comparison with the automobile, and which will spread the demand for good roads into every section of the United States and Canada. It is therefore safe to predict that long before the Twentieth Century has half run its course—and in all probability before its second quarter has begun—it will be possible to start from any city of the United States and proceed by automobile in perfect comfort over perfect highways through to the City of Mexico. And that will be a trip well worth the making.

Automobile Clubs and their Functions

The millions of capital that have been invested in automobile undertakings the past year—such as the establishment of enormous manufacturing plants and the formation of powerful companies in all the principal centres for the systematic conduct of the business—will, in the course of this year, begin to make a great showing for the expenditure, and it will not be long before the automobile will be as familiar a sight as the bicycle, not only in the cities, but in the populous country districts as well. Every approved form of motor-vehicle—whether electricity, steam, or petroleum, furnish the motive-power—appears now to be developing along the right lines, and each will have its due place in the great work now under way.

Another direction in which admirable progress has been made lies in the social organization of the movement. The Automobile Club of America, recently formed here in New York, is the pioneer of its kind in this country, and it almost immediately proved the immense value of associated effort by straightway acting with energy to secure the opening of Central Park to the automobile on a par with other pleasure-vehicles. Similar organizations are talked of for Chicago, Philadelphia, Boston and other great centres, and will doubtless be effected early in the course of the year.

Editorial

Among the activities in which such organizations may be expected to take the lead is the organization of meets, races, long-distance and short-distance tours, exhibitions, etc., for their respective localities, and these activities will contribute powerfully to the cultivation of a general feeling of community of interests among all concerned in the movement. An invaluable function, of course, as we have seen in the case of the New York organization, lies in securing to the automobile its proper rights in the public highways and pleasure-grounds, as well as in the defense of automobilists against the various aggressions and persecutions certain to arise here and there. Another important function lies in the securing and diffusion among members of all sorts of information concerning roads, routes, wayside taverns, etc., together with the establishing of stations for replenishment of motive-power, repairs, etc. For instance may be cited the following inquiry recently made of a technical journal:

"Do you know if such a thing is to be had as profile maps of the various roads radiating from New York, showing at a glance distances, gradients and length of same, together with descriptions of the roadbed? I have been looking for such maps, and I have so far been unable to find them, although they are in use in England, and are of great assistance, especially to cyclists and automobilists. Of course, if any one takes the trouble, he can take the ordinary contour maps and make for himself a profile plan, but the average man does not care to go to this trouble, but would rather trust to chance as to what he will find. Such books would be extremely useful to people desiring to go as far as possible on one charge."

The example of the League of American Wheelmen in furnishing to its members systematic information similar to that desired in the foregoing is one that may well be followed. For instance, the Massachusetts Road Book, supplied to its members by the Massachusetts division of the League, is a model of its kind, containing not only excellent maps of the roads throughout the State, but lists of routes, and much compact information of the kind desired as to character of roads, gradients, etc. Since automobilists are interested in many of the same things that wheelmen are it has been suggested that mutual interests would be promoted if the former would join the L. A. W. It would, indeed, be a most advisable thing to do. The return for the small entrance-fee and annual charge is very large.

Good Roads and Automobiles

An automobile street-sprinkler would be something very useful, and it would effect a great economy in the work. One form of automobile street-sprinkler is that in use on many electric street-railways, and it has proven itself very efficient. Its advantages, however, are confined to those streets where there are car-tracks. An automobile street-watering cart free to run anywhere would extend the benefits of the system to all parts of a town. It would not only do the work more evenly than with animal traction, but would accomplish it so much more quickly that one automobile-sprinkler could cover a much larger territory in the same time, and therefore do the work probably of at least two carts drawn by horses. Another great economy lies in the fact that where street sprinkling is done by contract the arrangement has to be for a season of so many days, regardless of the fact that wet weather may make sprinkling unnecessary for many of these days. With automobile watering-carts the necessity for such a waste in expenditure would be overcome. Running-expense would be confined to the time of actual operation, and not extended over the periods when horses stand idle in the stable. An official in one of the largest park departments of this country, where the cost of road-sprinkling is something over ten thousand dollars a year, says that the saving by the use of automobile-sprinklers would amount to fully half that sum. An additional advantage of the automobile-sprinkler would be the fact that, therewith, road-sprinkling would be practicable in rural communities where there is no system of public water-supply. The advantage of dustless roads would therefore be greatly extended, to the great comfort and convenience of all concerned, and it would save macadamized State highways, constructed at great expense, from the destructive influences of seasons of drought, when for the lack of binding moisture the road-bed disintegrates and is ground into fine powder that blows away. For it would easily be possible so to construct an automobile road-sprinkler that, by means of its own motive-power, it could quickly fill itself by pumping from a pond, stream, or well, so that it would not be necessary to pump water into an elevated tank for the purpose. It would thus be possible to keep the roads in large public parks well sprinkled without going to the great expense of either building such tanks at frequent intervals or of extending the mains from the public supply solely for such a use. Yet another advantage of the automobile-sprinkler would be its additional function

as a road-roller. For it would naturally be provided with heavy wheels having a very wide tread. And the weight of the water, carried in quantity much larger than it would be practicable for horses to pull, would make a most admirable road-roller of the machine, constantly improving the surface while sprinkling it.

The Exaggeration of Motor Horse-Powers

Apart from durability and economy, efficiency is one of the most vital points to be considered in the purchase of a motor for automobile use. If our automobilists were to subject their motors to the brake-test they would find them credited with horse-powers far in excess of that which they are actually capable of developing. The evil of exaggerating the commercial rating of engines has been admirably discussed in a trenchant article from the pen of a prominent engineer, which we have published in this issue, and which will probably offer food for thought to many of our readers. The simple brake-test described in the article in question, although well known to every engineer, will probably be new to many automobilists.

American manufacturers are capable of building the finest motors in the world—motors which have earned for themselves well-merited praise wherever they have been used. It seems on this account all the more deplorable that American makers should resort to means so utterly unworthy of them in advertising their product.

Warning-Signals

What should constitute the warning-signal for automobiles? This is a very important question. In Europe the pneumatic horn is commonly used, making a noise similar to that of a steam-whistle. In this country the tendency is to employ a gong for the same purpose. This, however, is open to the objection that the equipment is similar to that of the electric street-car, so that accidents are liable to arise through mistaking the approach of an automobile for that of the latter, the passer therefore deeming himself out of danger when clear of the car-tracks. With the use of the horn, however, there would be no danger of such a mistake. If the horn were adopted for the automobile in this country, its use would then be practically universal for the automobile, and uniformity the world over in such a matter is something desirable. Perhaps legislation to that end may be found necessary.

The Automobile Magazine

Motor Racing

The record-breaking run of an American electric automobile over a course of 100 miles, which is so entertainingly described by Hiram Percy Maxim in this issue, serves to draw attention to the subject of motor racing. This is a sport which is bound to come into great vogue, stimulated as it has been by the recent gift of James Gordon Bennett's International Challenge Cup.

Only last July Mr. Bennett's newspaper, the New York *Herald,* published and double-leaded a cable despatch from Paris announcing that the world's record for automobiles had been broken by Count Chasseloup-Laubat, who had succeeded in making a journey of 81.6 miles on a single charge of an electric storage battery weighing 2,000 lbs., while the vehicle itself weighed 2,400 lbs. more. The *Herald* then declared that this " opened up possibilities of a far reaching character."

Mr. Maxim's run of a trifle more than 100 miles was made in 7 hours and 45 minutes. The distance was carefully measured off by three bicyclists who went in advance of the motor carriage setting up marks at every fifth mile. The time of both start and finish were recorded by disinterested spectators who were called on as witnesses. The storage battery of the vehicle which accomplished this run on a single charge weighed 980 lb., while the vehicle without the batteries weighed 1,200 lb., bringing up the total weight to 2,500 lb., with the passengers. The voltage of the battery was 98 at the start, fell to 97 during the second and third hours, 93 during the fourth hour, 92 in the fifth, 89 during the sixth, finally falling to 81.7 toward the close of the seventh hour. A good part of the distance was covered at a three-minute gait, and the average speed for the whole distance was 16.8 miles per hour. The battery charge for the 100 mile journey was 190 ampere hours, of which the cost was about $1.25. The actual cost of this amount of energy at the dynamo is 41 cents.

Mr. Maxim is to be congratulated on this brilliant demonstration of the *Herald's* prediction of American possibilities.

A Warning to the Public

A timely note of warning has been raised by a writer in *La Locomotion Automobile.* This gentleman, who is a lawyer and practising member before the French Court of Appeals, warns

intending exhibitors at the Paris Exposition of 1900 to be on their guard. Not only does he apprehend great danger from unscrupulous imitators of new devices and inventions not covered by French patent rights, but he is furthermore of the opinion that valuable trade names will be similarly appropriated.

This is a timely warning and one that is bound to be heeded by the exhibitors of automobiles and automobile appliances. In the past, as will be recalled by many American manufacturers, there have been so many complaints on that score in France that intending exhibitors should take every precaution to safe-guard their wares. We are in hearty accord with the suggestion of *La Locomotion Automobile* that a judiciary tribunal should be appointed during the Exposition year in Paris with powers to make a quick disposition of all cases of infringement of patent rights and trade-marks arising between French manufacturers and foreign exhibitors.

The Latest Postal Reform

Since the publication of the latest annual report of the Postmaster General, new efforts have been made to carry out his suggestion for the adoption of automobiles in the postal service. By a circular request of the Assistant Postmaster, inventors and manufacturers have been invited to submit their designs for postal automobiles to the authorities at Washington. Besides this the postmasters of likely cities, such as Brooklyn, Buffalo, Boston, Washington and Chicago, have been authorized to conduct a series of tests with such automobiles as may be submitted to them by local manufacturers.

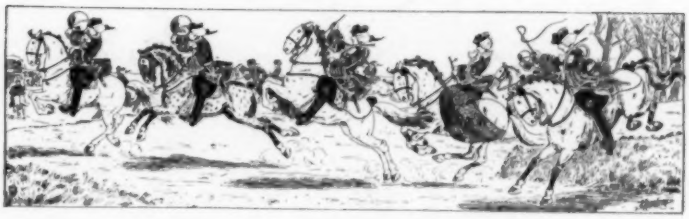
The results of these tests and of this new departure in our postal service will be submitted to the readers of our next issue in an able article by First Assistant Postmaster General Perry S. Heath, amply illustrated by photographs and drawings of postal automobiles already in use. Most of these are taken from illustrations of postal cars and delivery wagons adopted by the governments of Germany, France and England, but a few, it will be noted, are now already in active use in some of our American cities.

The Speeding of the New Year
(VICTOR GILLAM in *Judge*)

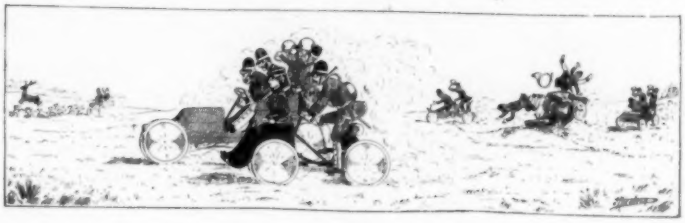
His Occupation Going
(CHARLES NELAN *in the New York Herald*)

Automobile Humors

THE MERRY CHASE

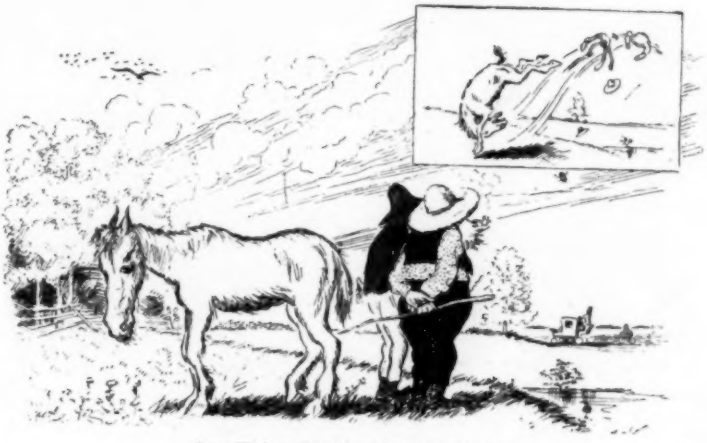


1700



1900

(E. NICOLSON in *Charivari*)



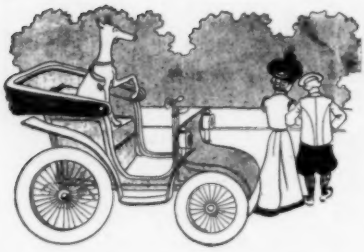
One Thing the Machines Can't Do

FARMER GREEN—"If they keep on usin' bicycles an' horseless kirrages, I'd like to know what the horses are goin' to do?"

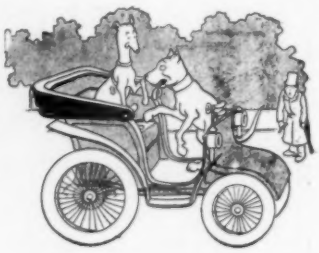
OLD HORSE—"Don't worry; I can kick."—*Puck.*

The Automobile Magazine

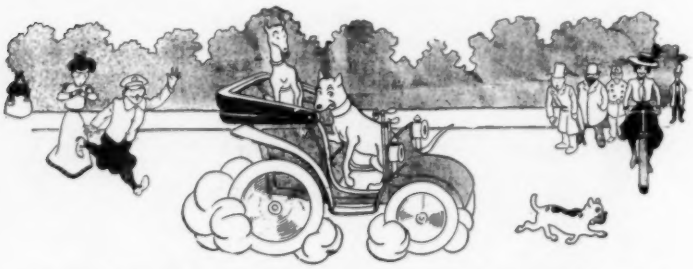
EVERY DOG HAS HIS DAY.



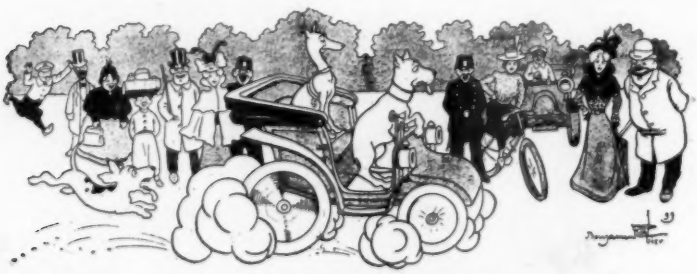
Mirza guards the automobile while Gaston and Yvette seek a secluded nook.



A brave Dane profits by the occasion to flirt with little Mirza.



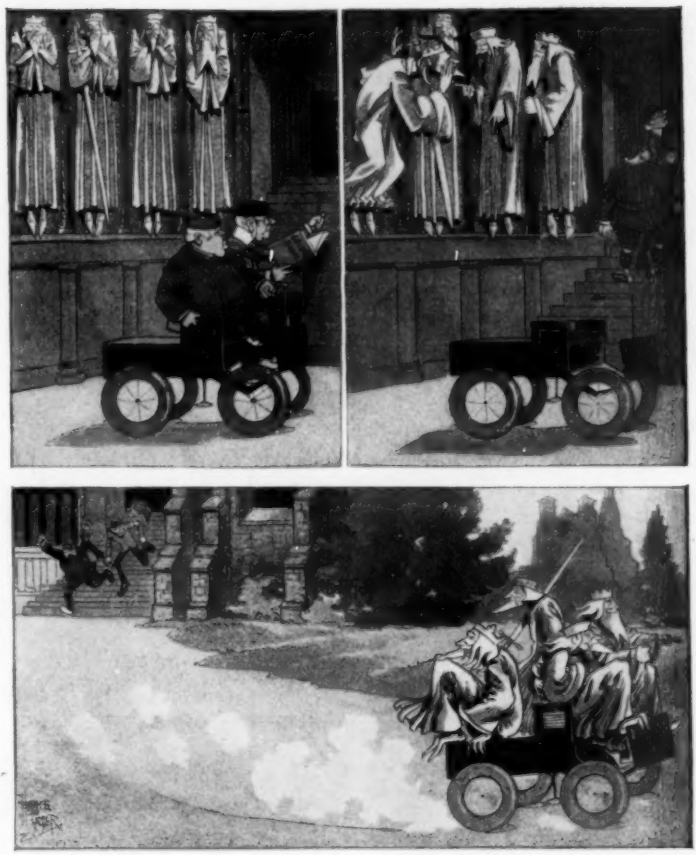
He wags his tail so expressively that he turns the lever and starts the machinery. Buzz! Buzz! goes the motor, and they are under way.



Behold Mirza and her gallant escort making the rounds of the Bois de Boulogne at the rate of 40 kilometers per hour despite all ordinances.

(B. RABIER *in the Journal Amusant.*)

Automobile Humors



Off for a New Crusade

(HORACE TAYLOR in *The Verdict*)

LOVE AND SCIENCE

We hear of horseless carriages,
  Propelled by unseen force;
Also of loveless marriages,
  Which generate divorce.
We hear of wireless telegrams,
  A wonder of our day;
But 'twixt them armless courtships
  Will never come to stay.

The Automobile Index

Everything of permanent value published in the technical press of the world devoted to any branch of automobile industry will be found indexed in this department. Whenever it is possible a descriptive summary indicating the character and purpose of the leading articles of current automobile literature will be given, with the titles and dates of the publications.

Accumulator Charging Plant—

A brief notice referring to the Berliner Maschinenfabrik's portable combination for the charging of electric accumulators. One illustration. "The Motor-Car Journal," London, November 10, 1899.

Accumulators—

A serial article, by E. C. Rimington, on the construction of accumulators for automobiles. "The Automotor Journal," London, November, 1899.

Automobile Fore-carriage—

Five illustrations showing the Heilmann automotor fore-carriage as applied to various vehicles. "La France Automobile," Paris, November 12, 1899.

Automobile Management—

A serial article by "Philauto," giving practical hints to the users of automobiles. With four illustrations. "The Motor-Car World," London, November, 1899.

Automobile Street Sweeper and Sprinkler—

From *La Nature*. Gives illustrations and particulars of an apparatus which has given very satisfactory results in Paris. 500 w. "Scientific American" (Supl.), October 7, 1899.

Automobiles and Public Health—

By James J. Walsh, M. D. "The Automobile Magazine," December, 1899.

Axles—

Illustrated description of the Stourmel axle for the front motor and steering gear of delivery wagons, "L'Industrie Automobile," Paris, October, 1899.

Balancing of Motors—

A mechanical study by H. E. Wimperis, Wh. Sc., with illustrations. "The Automotor Journal," London, November, 1899.

Brakes—

Daniel Dujon's new "cable brake," described and illustrated. "La Locomotion Automobile," Paris, October 19, 1899.

Carbureters—

An improved form of carbureter devised by Mr. M. H. Lepape, of Paris. Described and illustrated. "The Motor-car Journal," London, November 10, 1899; also "The Automotor Journal," November, 1899.

Compensating Crank Shaft—

A full description of Whitney's compensating crank shaft. Three illustrations. "The Motor Age," Chicago, November 23, 1899.

Compensating Gear—

Description of a compensating gear invented by Messrs. W. E. Wentzel, of Lynn, and G. E. Whitney, of Boston, Mass. Four illustrations. "The Motor Vehicle Review," Cleveland, O., November 14, 1899.

The Automobile Index

Elastic Clutch—

Description and illustration of the Syner's elastic clutch, by William Rogers, C. E. "The Automobile Magazine," December, 1899.

Electric Automobiles—

Electrically Driven Automobiles. (Ueber Elektrisch Betriebene Selbst fahrer). C. P. Feldmann. A review of the electrically driven vehicles shown at the recent Paris competitions. "Elektrotechnische Zeitschrift," October 5, 1899.

Electric Cabs in Chicago. Illustrates and describes the vehicles of the Illinois Electric Vehicle Transportation Company, giving related information. "Western Electrician," October 7, 1899.

Pullen Company's electric carriage, described and illustrated. "The Automobile Review," Chicago, November, 1899.

Description of Wood's various vehicles, with five illustrations. "The Motocycle-Automobile," Chicago, November, 1899.

The new Hurtu carriage described by Mr. A. Delasalle. Five illustrations. "La Locomotion Automobile," Paris, November 9, 1899.

Illustrated description of the "Columbia" electric omnibus. "Elec. World and Engineer," New York, November 18, 1899.

The Keating delivery wagon described and illustrated. "The Motor Vehicle Review," Cleveland, O., November 21, 1899.

Illustrated description of an electric carriage built by the United States Automobile Co. "The Motor Age," Chicago, November 30, 1899; also "Motor Vehicle Review," Cleveland, O., December 5, 1899.

Description of a new carriage built by the Hub Motor Co. One illustration. "The Motor Age," Chicago, November 23, 1899.

The latest Oppermann electrical dog-cart, fitted with its new chainless driving gear. An illustrated description. "The Motor-Car Journal," London, November 24, 1899.

The latest Columbia vehicles, described and illustrated. "The Motor Vehicle Review," Cleveland, O., December 5, 1899.

"The Electric Automobile," a serial article by Prof. Felicien Michotte (continued from "The Automobile Magazine" for November). "The Automobile Magazine," December, 1899.

Electric Motors—

Illustrated description of a new motor built by the Lincoln Electric Co. "The Motor Vehicle Review," Cleveland, O., December 5, 1899.

Electric Touring—

An article on the use of electrical automobiles by tourists in France. "La Locomotion Automobile," Paris.

Exposition—

The International Motor Carriage Exposition at Berlin. An Account of the opening of this exposition, with illustrated description of some of the vehicles. U. S. Consular Reports, No. 561, October 24, 1899.

First American Automobile Club Run—

By Edgar S. Hyatt. "The Automobile Magazine," December, 1899.

Hints on Avoiding Accidents—

Advice to drivers of automobiles on necessary conditions for safety. "Cycle et Automobile Industriel," Paris, September, 1899.

Hydro-carbon Automobiles—

The new "Star" automobile, as exhibited in the London National Show, An illustrated description. "The Autocar," Coventry, November 25, 1899.

The Beeston Light two-seated automobile, described and illustrated. "The Autocar," Coventry, November 25, 1899.

The Automobile Magazine

Illustrated description of a new automobile built by the Alldays & Onions P. E. Co. Its motor is of the double horizontal cylinder type. "The Autocar," Coventry, November 25, 1899.

A new voiturette invented by André Py, of Paris; described and illustrated. "L'Industrie Automobile," Paris, October, 1899.

Description of the new Rossel gasoline carriage, with four illustrations. "L'Industrie Automobile," Paris, October, 1899.

Illustrated description of the "Rochet" carriage. "Le Chauffeur," Paris, October 11, 1899.

Illustrated description of several vehicles propelled by acetylene motors. "The Automobile Review," Chicago, November, 1899.

Illustrated description of the Haynes-Apperson phaeton and of its run of 1,050 miles in twenty days. "The Motocycle-Automobile," Chicago, November, 1899.

Description of the Société Bourguignone's three-seated voiturette. Three illustrations. "The Motor-Car Journal," London, November 10, 1899.

Description of the "Esculape" voiturette, by Mr. Georges Cruchet. With two illustrations. "Le Chauffeur," Paris, November 11, 1899.

A new style of Bollée four-wheeled voiturette, described by Mr. Frederik Gougy. Three illustrations. "Le Chauffeur," Paris, November 11, 1899.

A description of the Renault voiturette. With four illustrations. "The Autocar," Coventry, November 11, 1899; also "La France Automobile," November 12, 1899.

The Humber "Sociable Quadricycle," the Daimler Co.'s "New Parisian Car," the Roots and Venables' heavy oil carriage, the Dennis light doctor carriage, and the "Swiss Mountaineer" automobile. A descriptive article, with illustrations, of these vehicles as exhibited in the National Show (London). "The Motor-Car Journal," London, November 24, 1899.

Illustrated description of the Ernst petroleum motor carriage. "The Automobile Magazine," December, 1899.

Hydro-carbon Motocycles—

The Sanciome petroleum-bicycle, described and illustrated. "The Automobile Magazine," December, 1899.

The Butikofer Motocycle. A description and illustration of same. "The Automobile Magazine," December, 1899.

The Renaux gasoline tricycle described and illustrated. "L'Industrie Automobile," Paris, October, 1899.

Illustrated description of the "Rochet" motocycle. "Le Chauffeur," Paris, October 11, 1899.

Description and illustration of Prof. Herring's motocycle called the "Mobike Tandem." "The Autobain," November, 1899.

Description of Werner's new motor-bicycle One illustration. "The Motor-car Journal," London, November 17, 1899.

An illustration showing the new motor bath chair made by the Rover Cycle Co. of Coventry, Eng. "The Autocar," Coventry, November 18, 1899.

Illustrated description of the Enfield quadricycle. "The Autocar," Coventry, November 25, 1899.

Description and illustration of the Edmond tricycle. "Cycle and Auto. Trade Journal," Philadelphia, December 1, 1899.

Description and illustration of the Boyer bicycle. "Scientific American" (Supl.), New York, December 9, 1899.

The Girardot gasoline bicycle, illustrated. "Scientific American" (Supl.), New York, December 9, 1899.

Illustrated description of the Lamandiere et Labre bicycle. "Scientific American" (Supl.), New York, December 9, 1899.

Mechanism of the Girardot bicycle, illustrated. "Scientific American" (Supl.), New York, December 9, 1899.

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The Richard-Choubersky automobile tandem, described and illustrated. "Scientific American" (Supl.), New York, December 9, 1899.

Hydro-carbon Motors—

A full description of the Henriod motor, with four illustrations. "L'Industrie Automobile," Paris, October, 1899.

Illustrated description of a multiple-cylinder motor patented by the Gesellschaft fur Automobilewagenbau, of Germany. With four illustrations. "La France Automobile," Paris, November 5, 1899.

A full description and illustration of the Dawson self-starting, reversing and power-increasing motor. "The Autocar," Coventry, November 11, 1899.

Description of a new gasoline motor designed by Mr. M. T. Minogue, of Springfield, O. Three illustrations. "The Motor Vehicle Review," Cleveland, O., November 14, 1899.

A new motor built by "La Minerve" Company. An illustrated description. "La Locomotion Automobile," Paris, November 16, 1899.

The Kuhlstein-Vollmer detachable motor, described and illustrated. "Cycle and Auto. Trade Journal," Philadelphia, December 1, 1899.

Igniters—

An illustrated description of the Houpied igniter. By Paul Sarrey, "The Automobile Magazine," December, 1899.

Illustrated description of the Gianoli & Lacoste devices for ignition in motors. "Le Chaffeur," Paris, October 11, 1899.

Simms' patent ignition gear, described and illustrated. "The Autocar," Coventry, November 18, 1899.

Mechanical Propulsion and Traction—

By Prof. G. Forestier. "The Automobile Magazine," December, 1899.

Motocycle Management—

Serial articles, by Mr. A. J. Wilson, under the title of "Motor Cycles and how to manage them." Three illustrations. "The Autocar," Coventry, November 11 and 18, 1899.

Motor Vehicles—

Horseless carriages. By George N. Crouse. Brief review of progress in France, England and the United States. "Yale Sci. Monthly," October, 1899.

Reformation of Horseless Vehicles—

An article by Miss Clara Fazan on the necessity of reforming the construction of automobiles. "The Motor-car Journal," London, October 27, 1899.

Santa Claus Gets a New Plaything—

By Sylvester Baxter. "The Automobile Magazine," December, 1899.

Speed Varying Gear—

Description of Gaillardet's speed varying gear, with three illustrations. "La France Automobile," Paris, November 5, 1899.

The Newton speed varying gear, described and illustrated. "The Autocar," Coventry, November 18, 1899.

Steam Automobiles—

The Simpson and Bodman Steam Lorry. An illustrated detailed description of vehicles of new design, the generator, and tests made. "Automotor Journal," October, 1899.

Description of the "Stanley" voiturette, with eight illustrations, by Mr. Paul Sarrey. "La Locomotion Automobile," Paris, November 2, 1899.

The Baldwin steam carriage, described and illustrated. "The Motor Age," Chicago, November 23, 1899.

Illustrated description of the Leach steam motor carriage. "The Motor Age," Chicago, November 23, 1899; also "The Automobile Review," Chicago, November, 1899.

Description of some steam vehicles built by E. F. Brown in 1882–83. Two illustrations. "The Motor Age," Chicago, November 30, 1899.

Steam carriages of the Société Européenne d'Automobiles. An illustrated description. "The Automobile Magazine," December, 1899.

Steam Dray—

The Coulthard new three-ton steam dray, described and illustrated. "The Motor-Car Journal," London, November 10, 1899; also "The Autocar," Coventry, November 18, 1899.

Steam Motors—

Illustrated description of the Chandler device to control the distribution of steam in automobile motors. "La Locomotion Automobile," Paris, November 2, 1899.

Steam Omnibus—

A brief description of the Coulthard colonial steam omnibus now in use in West Australia. One illustration. "The Autocar," Coventry, November 18, 1899.

Steering—

Serial articles, fully illustrated, on steering by means of the divided axle. Dr. C. Bourlet. "La Locomotion Automobile," Paris, October 19 and 26; also November 2, 9 and 16, 1899.

"The Steering of the Automobile," a study on this subject by "Indus." With eight illustrations. "The Motocycle-Automobile," Chicago, November, 1899.

Robert W. Jamieson's steering device, described and illustrated. "The Horseless Age," New York, November 9, 1899.

Steering Mechanism—

Illustrated description of a new steering mechanism invented and patented by Mr. A. V. Kendall, of Hartford, Conn. "The Motor Vehicle Review," Cleveland, O., November 21, 1899; also "The Motor Age," Chicago, November 23, 1899.

The Horseless Fire Engine—

By Captain Cordier of the Paris Sapeurs-Pompiers Regiment. "The Automobile Magazine," December, 1899.

The Influence of Automobilism on Transportation—

A work by Herr Berdow, of Leipsic, Germany.

Trials—

Competitive trials of electric accumulators in Paris. Results of tests made during the months of August and September, 1899. "La Locomotion Automobile," Paris, October 19, 1899.

Competitive trials of hydro-carbon motors in Paris. Described and illustrated. "La Locomotion Automobile," Paris, October 19, November 2, 9 and 16, 1899.

Ventilation—

The Removal of Odors from Electric Battery Vehicles (Geruchbeseidigung in Akkumulatorwagen). R. Ulbricht. Describing methods of ventilating the batteries of electrical vehicles so as to prevent unpleasant odors. "Elektrotechnische Zeitschrift," September 28, 1899.

Wheels—

An article on the necessity of a type of wheel that will withstand different varying stresses. The principles of the compression and suspension types are explained in detail. "The Motor Age," Chicago, November 14, 1899.

The World on Wheels—

By Edwin Emerson, Jr. Historical review of the evolution of vehicles. Illustrated. "The Automobile Magazine," December, 1899.

Women and Automobilism—

By Miss N. G. Bacon. Paper read at Lady Harberton's house in London. "The Automobile Magazine," December, 1899.